SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

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GENERAL MEETING OF THE AMERICAN PHILOSOPHICAL SOCIETY.

THE general meeting of the American Philosophical Society was held in Philadelphia on Thursday, Friday and Saturday, April 2, 3 and 4. A large number of members were in attendance, and the meeting was in every way a most successful and important one. Morning and afternoon sessions were held in the historic hall of the society on Independence Square, and luncheons were served here each day to members and invited guests. On Thursday evening a reception for members of the society and their friends was held at the hall of the Historical Society of Pennsylvania, on which occasion the president, Professor Edgar F. Smith, delivered an address on the origin and early history of the American Philosophical Society, which will be published in full elsewhere. On this occasion President Daniel C. Gilman of the Carnegie Institution also spoke on the work of that institution during the first year of its development. Professor Wm. H. Welch, who was to have spoken on the objects and aims of the Rockefeller Institute for Medical Research, was prevented by sickness from being present.

At the close of the morning session on Friday the annual election of members was held, and the following persons were chosen:

Residents of the United States.—Edward E. Barnard, Sc.D., Williams Bay, Wis.; Carl Hazard Barus, Ph.D., Providence, R. I.; Franz Boas, Ph.D., New York; William W. Campbell, Sc.D., Mt. Hamilton, Cal.; Eric Doolittle, Philadelphia; Basil Lanneau Gildersleeve, LL.D., Baltimore; Francis Barton Gummere, Ph.D., Haverford, Pa.; Arnold Hague, Washington, D. C.; George William Hill, LL.D., Nyack, N. Y.; William Henry Howell, Ph.D., Baltimore; Edward W. Morley, Ph.D., Cleveland; Harmon N. Morse, Ph.D., Baltimore; Edward Rhoads, Haverford, Pa.; Alfred Stengel, M.D., Philadelphia; William Trelease, Sc.D., St. Louis.

Foreign Residents.—Anton Dohrn, Naples; Edwin Ray Lankester, LL.D., F.R.S., London; Sir Henry E. Roscoe, F.R.S., D.C.L., London; Joseph John Thomson, D.Sc., F.R.S., Cambridge, Eng.; Hugo de Vries, Amsterdam.

Action was also taken at this session looking to the adequate celebration of the two hundredth anniversary of the birth of Franklin, the founder of the organization. This was expressed in the following preamble and resolution which were unanimously adopted:

> Inasmuch as the two hundredth anniversary of the birth of Benjamin Franklin occurs in January, 1906, it is proper that the American Philosophical Society, which owes its existence to his initiative and to which he gave many long years of faithful service, should take steps to commemorate the occasion in a manner befitting his eminent services to this society, to science and to the nation. Therefore be it
>
> *Resolved*, That the president is authorized and directed to appoint a committee of such number as he shall deem proper to prepare a plan for the appropriate celebration of the bi-centennial of the birth of Franklin, and to report the same to this society.

The president appointed the following members to constitute the committee: Hon. George F. Edmunds, *Chairman;* Professor Alexander Agassiz, Boston; President James B. Angell, Ann Arbor; Professor George F. Barker, Philadelphia; Professor A. Graham Bell, Washington; Mr. Andrew Carnegie, New York; Professor C. F. Chandler, New York; Hon. Grover Cleveland, Princeton; President Charles W. Eliot, Cambridge; President Daniel C. Gilman, Baltimore; President Arthur T. Hadley, New Haven; Provost C. C. Harrison, Philadelphia; Hon. John Hay, Washington; Dr. I. Minis Hays, Philadelphia; Professor Samuel P. Langley, Washington; Capt. Alfred T. Mahan, U. S. N.; Dr. S. Weir Mitchell, Philadelphia; Professor Simon Newcomb, Washington; Governor S. W. Pennypacker, Harrisburg; Professor E. C. Pickering, Cambridge; Professor Michael I. Pupin, New York; President Ira Remsen, Baltimore; Professor John Trowbridge, Cambridge; Dr. Charles D. Walcott, Washington; Hon. Andrew D. White, Ithaca; President Woodrow Wilson, Princeton.

On Friday evening the annual dinner of the society was held at the Hotel Bellevue, at which about eighty members were present, the occasion being a most enjoyable one and a fitting climax to the social side of the meeting. Professor W. B. Scott acted as toastmaster and the following toasts were responded to:

'The Memory of Franklin,' Professor Albert H. Smyth, of Philadelphia.

'Our Sister Societies,' Rear Admiral Melville, of Washington, and Professor Henry F. Osborn, of New York.

'Institutions for the Promotion of Knowledge,' Dr. Cyrus Adler, of Washington.

'The American Philosophical Society,' Mr. J. G. Rosengarten, of Philadelphia.

The opinion was freely expressed, by many members who had come from a distance, that the entire meeting was one of the most enjoyable and profitable which

they had ever attended. All were hearty and unanimous in the desire that the general meetings of the society should be continued and made an annual event. No further justification of these meetings is needed than that they have been successful, that they have attracted many members from a distance and that their continuance is desired by those who are acquainted with them; furthermore, it should not be necessary to defend our oldest scientific society for carrying out in practical form the broad policy which it has upheld for more than a century and a half.

Nevertheless, since there has been some misunderstanding as to the purpose of these general meetings, it may not be amiss to point out the fact that in no sense are they intended to antagonize or to supplant the meetings of other societies. On the contrary, they occur at a time when few other societies are meeting and they attract papers of a general rather than of a specialized character. The broad and comprehensive scope of the society, which includes the whole range of useful knowledge, so far from being a hindrance to the success of the meetings, has been a particular attraction and source of strength. The opportunity of hearing and becoming acquainted with men eminent in the most diverse fields of thought is likely to promote catholicity of spirit even if it does not greatly advance individual specialties, and, after all, the present world stands quite as much in need of the former as it does of the latter. Amidst all the special societies which exist in this country there is surely room for one which shall welcome learned men from all fields whatsoever, and it is fitting that this common meeting ground should be the oldest learned society in America, founded by the many-sided Franklin, and devoted to the promotion of useful knowledge, 'nullo discrimine.'

The program of the meeting with abstracts of some of the papers presented follows; most of these papers will be printed in full in publications of the society:

THURSDAY, APRIL 2.

Morning Session, 10 o'clock.

President Smith in the chair.

President's Address of Welcome: Professor EDGAR F. SMITH.

The Structure of the Corn Grain and Its Relation to Popping: Professor HENRY KRAEMER, of Philadelphia.

There is a marked difference in the structure of the several parts of corn grains, and according to the character of the endosperm three distinct kinds of grains may be distinguished as follows: (1) One variety, representing the sweet corns, contains comparatively few nearly spherical starch grains from 4 to 10 microns in diameter, besides considerable dextrin becoming red with iodine, and a small amount of a reducing sugar. (2) The second class includes the dents and possibly also the soft corns, and in these the greater portion of the endosperm is whitish and more or less mealy; the starch grains in this mealy area are rounded or slightly polygonal, vary from 5 to 25 microns in diameter, and have a central rarefied area or point of origin of growth, which may be either wanting or usually not more than 2 microns in diameter. (3) The third class includes the pop-corns, in which the endosperm is more or less translucent and horny, and the cells of which contain closely arranged polygonal starch grains from 7 to 18 microns in diameter, and having a central rarefied area from 2 to 7 microns in diameter. Some of the flint corns closely resemble the pop-corns and form a group intermediate between the latter and the dent corns.

If the entire grains of these several groups are heated in a popper or in a hot-air oven at a temperature between 145°C.

and 160°C. for from four to ten minutes, there will be a splitting or popping open of the grain from the apex and a modification of the contents varying according to the kind of corn. In the sweet corn the grain swells very perceptibly, becoming hollow in the center, the endosperm becoming more or less friable and containing an increased amount of reducing sugars. In the dent corns there is a splitting of the hulls and the endosperm, and this may take place on the flat surface or along the edge, or the upper portion may separate like a lid. There is not much alteration in the endosperm cells of this class, only a small amount of soluble starch being formed. In the pop-corns there is a splitting of the grain along the two radii, the endosperm swelling very considerably, the peripheral portions cohering with the hull and thus leaving a central more or less rounded mass; where the popping is perfect the quarters turn back and meet below the embryo. On examining the endosperm of the popped grain it is observed that there has been considerable alteration in the starch grains and cell walls, and that the starch has been changed into a soluble form, the amount of which depends upon the degree of alteration in the endosperm cells and their contents.

The structural characteristics of the starch grains in the altered areas of the different pop-corns would seem to indicate that the popping of the grain of corn results from the expansion of the individual starch grains, the degree of expansion depending upon the relative amount of water and air in the grains. As an illustration of this it may be stated that perfectly fresh pop-corn or pop-corn that has been soaked in water for twenty-four hours will pop but little in the true sense of the word. On the other hand, a pop-corn which was seven years old, but had not lost its germinating power, would not pop unless first soaked in water and then allowed to dry for from four to twelve hours. That this property probably resides in the starch grain is further shown by the fact that pieces of the pop-corn grain will pop.

Beaver County (Pa.) Orchids: Mr. Ira Franklin Mansfield, of Beaver, Pa.

A brief account of twenty-eight species of orchids which the writer has found in Beaver County, Pa.

The Forward Movement in Plant Breeding: Professor L. H. Bailey, of Ithaca, N. Y.

The current idea in plant breeding is to breed 'varieties,' to produce something 'new' that can be named and described. However, a variety is not a thing or an entity, but only an aggregation of forms that agree rather more than they differ. Any one of these minor forms might be separated as another variety. The ultimate form or unit is the individual plant, and from this individual, irrespective of the variety it represents, the plant-breeding of the future must proceed.

The new idea is to breed for definite characters that make for efficiency. We must 'scale' our plants according to what they perform or what they contain. Thus, the new corn breeding does not attempt to produce new 'varieties' of corn, but to increase the efficiency of any variety by increasing its yield, protein or starch content, its drought-resisting or disease-resisting qualities. The new work with corn in Illinois, with wheat in Minnesota, with cotton and other crops by the United States Department of Agriculture, was described and illustrated.

The first thing that strikes one in all this work is its contrast with the old ideals. The 'points' of the plants are those of 'performance' and 'efficiency.' It brings into sharp relief the accustomed ideas as to what are the good 'points' in any plant, illustrating the fact that these points are

for the most part only fanciful, are founded on *a priori* judgments, and are oftener correlated with mere 'looks' than with efficiency. An excellent example may be taken from corn. In 'scaling' any variety of corn, it is customary to assume that the perfect ear is one nearly or quite uniformly cylindrical throughout its length, and having the tip and butt well covered with kernels. In fact, the old idea of a good variety of corn is one that bears such ears. Now, this ideal is clearly one of perfection and completeness of mere form. We have no knowledge that such form has any correlation with productiveness, hardiness, drought-resisting qualities, protein or starch content, and yet these attributes are the ones that make corn worth growing at all. An illustration also may be taken from string beans. The ideal pod is considered to be one of which the tip-projection is very short and only slightly curved. This, apparently, is a question of comeliness, although a short tip may be associated in the popular mind with the absence of 'string' in the pod; but we do not know that this character has any relation to the efficiency of the bean pod. We are now undergoing much the same challenging of ideas respecting the points of animals. These 'points,' by means of which the animals are 'scored,' are in large part merely arbitrary. Now, animals and plants are bred to the ideals expressed in these arbitrary points, by choosing for parents the individuals that 'score' the highest. When it becomes necessary to recast our 'scales of points,' the whole course of evolution of domestic plants and animals is likely to be changed.

We are to breed not so much for merely new and striking characters that will enable us to name, describe and sell a 'novelty,' as to improve the performance along accustomed lines. We are not to start with a variety, but with a plant. It is possible to secure a five per cent. increase in the efficiency of our field crops. This would mean the annual addition of hundreds of millions of dollars to the national gain.

The purpose, then, of our new plant-breeding is to produce plants that are more efficient for specific uses and specific regions. They are to be specially adapted. These efficiency ideals are of six general categories:

1. Yield ideals.
2. Quality ideals.
3. Seasonal ideals.
4. Physical conformation ideals.
5. Regional adaptation ideals as to climate, altitude, soil, etc.
6. Resistant ideals as to diseases and insects.

The main improvement and evolution of agriculture are going to come as the result of greater and better crop yield and greater and better animal production. It is not to come primarily from invention, good roads, rural telephones, legislation, discussion of economics. All these are merely aids. Increased crop and animal production are to come from two agencies—improvement in the care that they receive and improvement in the plants and animals themselves. In other words, the new agriculture is to be built upon the combined results of better cultivation and better breeding. So far as the new breeding is concerned, it is characterized by perfect definiteness of purpose and effort, the stripping away of all arbitrary and factitious standards, the absence of speculative theory and the insistence on the great fact that every plant and animal has individuality.

Development of the English Alphabet: Professor FRANCIS A. MARCH, of Lafayette College, Easton, Pa.

Language is growth. We will to utter sounds, and the muscles move by their own

laws. The sounds weaken by the law of least effort, strengthen under the accent, are assimilated by neighboring sounds while the writing of a word remains unchanged, so that any letter may come to stand for any sound and any sound be found represented by many different letters. This is the condition of a language as it grows. Such a language needs to be shaped by reason to the use of man.

An alphabet addressed to the eye is machinery to suggest the elementary significant sounds, and is open to improvement like all labor-saving machinery.

The Roman alphabet was a simple set of largely straight-line forms suited for cutting in stone from right to left like our capitals. It has been improved into cursive forms easily connecting from left to right. This change was established in the fifteenth century.

It brought two forms of *I* into use, *i* and *j*. The penmen often swept the *i* below the line with a flourish, and the types *i* and *j* were used indifferently for either the vowel or consonant force of the Roman *I*. In the beginning of the seventeenth century they were differentiated and *j* used only as a consonant.

The Roman *V* also had two cursive forms, *v* and *u*, used indifferently for vowels and consonants, differentiated at the same time, all under the lead, as our Dr. C. P. G. Scott has lately shown us, of the great scholar Philemon Holland and his printers.

The philologists have also developed six continuant lingual consonant diagraphs with a diacritic *h*, viz., *dh, th, sh, zh, dzh* $=j$, *tsh* $=ch$, to which the attention of workers in alphabetics is invited. There are also a new type *z* for sonant *s* and a nasal *ng*.

But the vowels are the most tangled field. Between *A* and *E* has been established the sound in 'at,' 'fare'; between *A* and *O* that in 'not,' 'nor'; between *A* and *U* that in 'fun,' 'burn.' Three new types are wanted. It is proposed to obtain them as Holland did. There are two forms (*a* and *ă*) used for both the sounds in 'father' and făt'; *a* is to be used always for the first, *ă* for the last. "I can't tell a lie, papa; you know I can't. I did it with my little hătchet." The words are not obscured, the spelling is perfected.

There are two graphic forms (*o* and *ŏ*) used for the sounds of 'no' and 'not'; *o* must be used only for the first, *ŏ* only for the second sound.

So let the lower case *u* be used only for the vowel in 'full,' 'rule' and the small capital *U* only in 'but,' 'burn,' etc. It will be seen in accompanying diagrams how easily the use of these types may be introduced, and how far the general use of them will go in reducing our chaos to cosmos.

The society is urged to use types in her documents as plainly within her general sphere, 'philosophy for fruit,' as a special field in which her members have always been leaders from Franklin to Haldeman, and the authors of the last state paper on spelling. This is a time of crisis. The language of the Pacific and the coming world ought not to be left to pidgin English.

Archeology and Mineralogy: Professor Paul Haupt, LL.D., Johns Hopkins University, Baltimore, Md.

In seven passages of the Old Testament we find references to a precious stone of Tarshish, *i. e.*, southern Spain (Exod. xxviii. 20, xxxix. 13; Ezek. i. 16, x. 9, xxviii. 13; Song of Solomon, v. 14; Dan. x. 6). As a rule, it is stated that the Greek Bible translates 'chrysolite,' and that the chrysolite of the ancients was our topaz; but the passage of Pliny quoted in support of this view clearly points, not to topaz, but to crystals of cinnabar. Anthrax also, which the Greek Bible has for

tarshish in Ezek. x. 9, means cinnabar. Pliny calls cinnabar *minium,* while we apply this term to the yellowish-red oxide of lead which is called by Pliny *usta cerussa.* Pliny says the best chrysolites are those which, when brought in contact with gold, make the gold look like silver; this is, of course, due to the 86 per cent. of mercury in the crystals of cinnabar (Pliny, xxxvii. 126: *optimæ sunt quæ in conlatione aurum albicare quadam argenti facie cogunt*). Pliny states that the Romans received cinnabar almost exclusively from Spain, and the best cinnabar came from *Sisapo,* the present quicksilver mines of Almaden, north of Cordova in southern Spain.

Just as Pliny applies the name *minium* to cinnabar, so the ancients used the name 'sapphire' for lapis lazuli. The ancients received lapis lazuli almost exclusively from the famous mines in Badakhshan, the mountainous region in northeastern Afghanistan, on the northeastern flank of the Hindukush, the Paropannisus of the ancients. The Assyrian king Esarhaddon (680–668 B. C.) calls this lapis lazuli mountain *Bikn,* adding that it was situated in the remotest part of Media. Esarhaddon must have advanced to the Paropannisus, as far east as did, three hundred years later, Alexander the Great, and the Macedonian conqueror would probably not have extended his victorious march so far east if he had not obtained in Babylonia some information regarding those eastern regions.

After we have established the fact that the sapphire of the ancients denotes lapis lazuli, while the stones of Tarshish represent crystals of cinnabar, we can explain the stanza in the Biblical love-ditties (Song of Solomon, v. 14) where the maiden describing the beauty of her lover says:

> His arms are poles that are golden,
> bedecked with rubies of Tarshish;
> His body is one piece of ivory
> adorned with azure blue sapphires.

That is, his bronzed arms are covered with ornamental designs tattooed in vermilion (the brilliant red pigment formerly made by grinding select pieces of cinnabar), while his white body is tattooed in ultramarine (the beautiful blue pigment formerly obtained from lapis lazuli). Tattooing has been common among the Semites from the earliest times. The mark which the Lord appointed to Cain was a tattooed tribal mark.

I maintain, therefore: the stones of Tarshish are ruby-like crystals of cinnabar from the quicksilver mines of Almaden, and Tarshish is a Phœnician word meaning 'dressing of ores,' especially 'spalling.' King Solomon's mines were located in southern Spain and in southeastern Africa; the silver came from Spain and the Ophir gold from the Eldorado north of the former South African Republic, opposite Madagascar.

The Activity of Mont Pelée: Professor ANGELO HEILPRIN, of Philadelphia. Illustrated with lantern slides.

Reaction as an Agent in Securing Navigable Depths in River and Harbor Improvements: Professor LEWIS M. HAUPT, of Philadelphia.

This paper dealt with the necessity which exists for deeper channels to meet the requirements of modern vessels; the inability of contending with the ceaseless activities of nature by mechanical means; the enormous tonnage which requires ample facilities for its rapid and economical distribution by the cheapest medium; the existing resources of the engineer as at present applied and the results secured therefrom; the rapid increase in the annual appropriation for the construction and maintenance

of this class of works, and the latest developments which have proved the practicability of a new form of tool for securing results by the utilization of the principle of reaction, instead of velocity and concentration by means of two jetties. It also emphasized the inability of currents of fresh water to scour to sufficient depths when buoyed up by the heavier salt water which obstructs and raises them on their path over a bar and the greater specific gravity of the wave-driven sand, or littoral drift, of which the bars of tidal inlets are composed. The location and cause of the abnormal depths found in gorges or under the lee of obstacles, and the resultant counter-scarps, illustrated by numerous slides showing the proper position and form to secure a continuous channel across an obstructing bar at half the cost of the usual devices, and by natural forces which will maintain the channels which they carve.

The above general claims and principles were illustrated and confirmed as to their value by a practical demonstration on a large scale of incompleted work on the coast of the Gulf of Mexico, which has proved to be remarkably permanent and effective.

Afternoon Session, 2 o'clock.

Vice-President Barker in the chair.

The Curtis Steam Turbine: Mr. W. L. R. Emmet, of Schenectady, N. Y.

The Principle of Least Work in Mechanics, and its Possible Use in Investigations Regarding the Ether of Space: Professor Mansfield Merriman, of Bethlehem, Pa.

The use of this principle in engineering computations was briefly explained. It was pointed out that its application is only valid in the case of bodies that are perfectly elastic and that its successful use in the determination of stresses in indeterminate structures depends upon this assumption. If the ether of space be perfectly elastic it is probable that the principle of least work can be applied to determine the stresses which accompany the action of gravitation, and an effort is being made in this direction, the results of which appear to indicate that the ether has properties in some respects unlike those of elastic bodies.

The Nernst Lamp (with experimental demonstration): Mr. Alexander Jay Wurts, of Pittsburg.

The Problem of the 'Trusts': Mr. C. Stuart Patterson, of Philadelphia.

An Inquiry into the Relation between the Objective Operations and Events Revealed to Us by the Scientific Study of Nature, and the Corresponding Actual Operations and Events Which are What Have Taken Place in the Universe of Real Existences: Professor G. Johnstone Stoney, F.R.S., of London.

Hitherto every attempt to ascertain the events that are actually happening in the universe of real existences—in other words, the study of ontology—has been pursued almost exclusively from the human standpoint of the metaphysician. This limited mode of treatment has led to a few negative results, which are chiefly of value by helping to dispel popular errors; but it has established little that is positive, or that can be of service to the scientific student of nature. And yet the scientific investigation of nature has led us in more than one direction into contact with problems of ontology—as when physiology brings us face to face with such a fact as that there is some interpendence between the thoughts that are our mind, and objective events going on in our brain. What help has ontology rendered in a case of this kind, or throughout our studies in physics, when we make any attempt to penetrate to the causes of the events that occur? In fact,

the inquiries hitherto made into ontology have been pursued on a wholly different plane, and do not seem to have solved any of the real enigmas which the study of nature presents. It appears, therefore, in an eminent degree desirable that an attempt shall be made to bring ontological studies into line with physical by ascertaining in what way the scientific study of nature (with which experience shows that the human mind is fitted to cope) stands related to the real events and real existences of which the universe actually consists (but which our human minds find it more difficult to probe).

The aim of the present paper is, therefore, to bring ontological and physical investigations into accord by substituting a Copernican for the Ptolemaic point of view of the metaphysician, and by throughout following up the ontological investigation from the standpoint of the student of nature.

FRIDAY, APRIL 3.

Morning Session, 10 o'clock.

Vice-President Langley in the chair.

The Double Star System Σ 518: Mr. ERIC DOOLITTLE, of Philadelphia. (Introduced by Professor M. B. Snyder.)

The Constant of Aberration: Professor CHARLES L. DOOLITTLE, of Philadelphia.

The Degree of Accuracy of the Newtonian Law of Gravitation: Professor ERNEST W. BROWN, F.R.S., of Haverford, Pa.

Two bodies attract one another inversely as the square of the distance, that is, if the distance be halved the force is increased four times; if the distance is divided by ten the force is increased one hundred times. This is the Newtonian law of gravitation. The moon, earth, sun and planets all should obey this law, which was discovered by Isaac Newton in the seventeenth century.

How far do the bodies obey it? The most sensitive is the moon. We are able to observe its motions so accurately and predict its places with such unfailing certainty by means of this law that we can scarcely have much doubt that it is correct. But, nevertheless, there are some small deviations, and the question is whether these deviations are due to errors in the calculations of astronomers or to something wrong in the law itself.

Hansen's theory of the moon's motion has been accepted up to the present, but there are still some small differences between his theory and observation. Two at least of these have been unexplained in the periods of revolution of the perigee and node. My calculations have shown that the differences are due to errors in Hansen's theory and that on a correct theory they do not exist. Thus it appears that Newton's law is accurate to one millionth per cent.! It is by far the most accurate physical law known and perhaps the most striking evidence of the fact that our existence and surroundings are not the result of chance.

New Applications of Maclaurin's Series in the Solution of Equations and in the Expansion of Functions: Professor P. A. LAMBERT, of Bethlehem. (Introduced by Professor C. L. Doolittle.)

In an equation of any degree, numerical or literal, $f(y) = 0$, introduce a factor x into several terms. There results an equation $f(x, y) = 0$ which defines y as an implicit function of x. The successive derivatives of y with respect to x are now formed, and the values of y and the derivatives found when $x = 0$. An application of Maclaurin's series gives the value of y in a series in powers of x multiplied by factors which depend on the coefficients of $f(x, y) = 0$. By properly selecting the terms of $f(y) = 0$ into which the factor x is introduced and placing $x = 1$ in the

series values of y, all the roots of the equation $f(y)=0$, real and imaginary, are found in convergent series involving only the coefficients of $f(y)=0$.

The same device of introducing a factor x which is eventually made unity makes it possible to obtain by a direct application of Maclaurin's series all the expansions which hitherto have been obtained by Lagrange's series and Laplace's series.

The Mechanical Construction and Use of Logarithms: Mr. Charles E. Brooks, of Baltimore. (Introduced by Professor George F. Barker.)

In this paper is described a simple instrument for constructing the logarithmic spiral with great accuracy. The device will be useful for drawing the curve in the class room; it may be used also for the preparation of tables of logarithms of all the possible systems, or for the mechanical solution of arithmetical problems.

The machine consists of a screw pivoted so that it may be rotated, but will remain parallel to the paper. A wheel is threaded to the screw and rests with its circumference on the paper. As the screw is rotated, the wheel rolls on the paper, but this rolling makes it travel along the screw. The track of the rolling wheel is, therefore, a spiral.

To show that this spiral is the logarithmic curve, consider the equation of motion of the center of the wheel, which has the same motion as the point which draws the curve. Let OA (see figure) be the screw, pivoted at O; let B be the wheel; C its center. Call C the point $\rho\theta$ measuring with O as origin and any line OP as axis. Let the pitch of the screw be p, and the radius of the wheel be r.

As θ increases an amount $\Delta\theta$, c moves through an arc cc' equal $\rho\Delta\theta$. At the same time the wheel turns through an arc $\rho\Delta\theta$, so the angular motion around OA is

$$\frac{\rho\Delta\theta}{r}.$$

Under the influence of the thread on OA it is moved along OA a distance

$$p\cdot\frac{\rho\Delta\theta}{r}.$$

But this distance is $\Delta\rho$, so we have

$$\Delta\rho=\frac{p\rho\Delta\theta}{r},$$

or

$$\frac{\Delta\rho}{\Delta\theta}=\frac{p}{r}\rho,$$

and in the limit,

$$\frac{d\rho}{d\theta}=\frac{p}{r}\cdot\rho.$$

Integrating,

$$\rho=ce^{\frac{p}{r}\theta}$$

That is, θ is the logarithm of ρ.

The Theory of Assemblages and the Integration of Discontinuous Functions: Professor I. J. Schwatt, of Philadelphia. (Introduced by Professor C. L. Doolittle.)

An historic review of the state of the theory of continuous and discontinuous functions prior to the creation of the theory of assemblages by Bolzano and Cantor is first given. It is then shown how the theory of assemblages has served to make this part of the theory of functions more clear and definite. The question of the content of a mass of points, distributed along a line, is discussed; the more important principles of the theory of assemblages are given, and applications of these principles to the integration of discontinuous functions are made.

The Franklin Papers in the Library of the American Philosophical Society: Mr. J. G. Rosengarten, of Philadelphia.

In the collection of this society there are some seventy large folio volumes of 'Franklin Papers.' Franklin left all his papers to his grandson, William Temple Franklin,

who, after a long interval, published in London and in Philadelphia six volumes of Franklin's works. Of course, this represented but a small part of his papers. Those used in the preparation of Temple Franklin's edition are now the property of the United States, which has never yet printed a calendar of them. Temple Franklin selected from his grandfather's papers those that he thought suitable for publication, and left the rest of them in charge of his friend, Charles Fox, to whom he bequeathed them, and Charles Fox, in turn, after a long lapse of years, presented them to the American Philosophical Society, in whose custody they have remained ever since.

They have been roughly classified, and are bound in a rude and careless way. Under the present efficient librarian, Dr. Hays, a calendar is being made as fast as the limited means at his disposal will permit, and, when that is completed, it is hoped that it will be printed as a useful guide to the miscellaneous matter collected here. Sparks, Hale, Ford, Parton, Fisher and others who have written about Franklin have used them, but even the most industrious student may well be appalled at the labor required to master all the contents of these bulky volumes, representing Franklin's long and many-sided activity.

He kept copies of most of his own letters and the originals addressed to him, often indorsing on them the heads of his replies. These volumes contain papers from 1735 to 1790—the first forty-four volumes, letters to him; the forty-fifth, copies of his own letters; the forty-sixth, his correspondence with his wife; the forty-seventh and forty-eighth, his own letters from 1720 to 1791; the forty-ninth, his scientific and political papers; the fiftieth, his other writings—notably his Bagatelles, those short essays which had such a vogue, and are still read; the fifty-first, poetry and verse, his own and that of others, no doubt selected by him for use in his publications; the fifty-second, the Georgia papers—he was agent for that colony; and the remaining twenty volumes all the multifarious correspondence, other than official, mostly during his long stay in France, his various public offices at home and abroad, his enormous correspondence about appointments from men of all nationalities, who wanted to come to America, under his patronage, to fight, to settle, to teach, to introduce their inventions, for every imaginable and unimaginable purpose.

Both in England and France he kept all notices of meetings, such as those of the Royal Society, and other scientific bodies of which he was a member, invitations, visiting cards, notes, business cards, etc., and at home he kept copies of wills, deeds, powers of attorney, bonds, agreements, bills and drafts, checks, bills of lading, public accounts and even certified copies of acts of Congress and account books, and, in addition, Temple Franklin left eight volumes of letters to him from 1775 to 1790.

In this mass of material his biographers have found much that was of value, but there remains almost untouched the interesting correspondence of his friends in England during the years before and those of the War of Independence. There are examples of his own clever *jeux d'esprit* in the 'Intended Speech for the Opening of the Parliament in 1774,' in which the King himself is made to foretell the 'seven or ten years' job' that his 'ministers have put upon him to undertake the reduction of the whole continent of North America to unconditional submission.' His friend Hartley sent it to him in 1786, when the prophecy had been fully realized. Again in 1778 he received a full report of the famous dying speech of Chatham and of that of Lord Shelbourne in his defense of the

American cause, speeches which have hardly been reported in full.

During these eventful years his correspondents in England and in the Colonies kept him well informed both of the actions and plans of the government and of the opposition. Some of these may be of interest as showing how earnestly both sides were presented to him, that he might use his influence to maintain peace. Priestley, who was then the secretary of Lord Shelbourne, writes from London in February, 1776, with a due report of political and scientific information, and Lee and Wayne write to him during the campaign which was to end in Burgoyne's surrender, and thus contribute largely to the alliance with France, which owed so much to Franklin's influence not only with the French court and French statesmen, but with the philosophers and the people.

His correspondence in Paris is a perfect picture of the time. One day he gets an invitation to attend experiments in electricity from a correspondent, Brogniart, who reports the successful treatment of sick people by electric fluid in 1778, and soon after the Curé of Damvillers asks him for a cure for dropsy for one of his parishioners.

His correspondence came from England and from all parts of the continent and from the West Indies in an unending stream.

A very curious letter is one from Richard Penn, dated London, October 20, 1778, which I think has never been printed, in which he says:

"I should think myself infinitely obliged to you if you could point out to me in what manner I could procure, either from America or in any other way, a temporary subsistence. I have not a doubt but that in time matters will turn out much to the advantage of everybody concerned and connected with that country."

When it is remembered that the hostility of the Penns to Franklin was so strong that Governor John Penn declined to be patron of the American Philosophical Society because it had chosen Franklin for its president, and that Richard Penn had been Lieutenant-Governor (as deputy for that uncle and his brother) from 1771 to 1773, it must have been difficult for Franklin not to feel that such a letter from such a man at such a time was indeed a tribute to his position, achieved solely by his own efforts.

It is well that this venerable society, so largely the result of his labors, should be made the custodian of the papers that follow almost his daily thoughts, and it is to be hoped that the preparation and publication of a calendar showing their contents may be completed at no distant day, certainly by the two hundredth anniversary of the birth of our founder, and thus perpetuate his memory.

Afternoon Session, 2 o'clock.

Vice-President Scott in the chair.

Further Notes on the Santa Cruz Edentates: Professor William B. Scott, of Princeton.

The fossil edentates of the Santa Cruz beds in Patagonia differ very notably from the forms now living in South America. Of the three edentate orders represented in the Santa Cruz, only one, the armadillos, has persisted to the present day, while no trace of the true sloths or of the ant-eaters has yet been found. The ground-sloths are very numerous and form very interesting evolutionary series leading to the giant species of the Pampean, while the armadillos and glyptodonts are, for the most part, away from the main line of descent.

An Attempt to Correlate the Marine with the Non-marine Jurassic and Cretaceous Formations of the Middle West: Professor John B. Hatcher, of Pittsburgh,

The Evolution and Distribution of the Proboscidea: Professor HENRY F. OSBORN, of New York.

A New Fresh-Water Molluscan Faunule from the Cretaceous of Montana: Mr. T. W. STANTON, of Washington. (Introduced by Professor W. B. Scott.)

This paper describes and discusses a collection of invertebrate fossils from near Harlowton on the Musselshell River, Montana, collected in 1902 by Dr. Farr and Mr. Silberling, of the Princeton University expedition.

The species are only six in number, but with one exception each is represented by abundant and well-preserved examples. Of these two are referred to *Unio,* two to *Goniobasis,* one to *Campeloma* and one to *Viviparus.* The study of these fossils, in connection with their reported stratigraphic position and a general discussion of the early Cretaceous and late Jurassic non-marine formations of the region, leads to the conclusion that they are probably from a horizon near the base of the Upper Cretaceous, or possibly as low as the Lower Cretaceous.

Hints on the Classification of the Arthropoda, the Group a Polyphyletic One: Professor ALPHEUS S. PACKARD, of Providence.

Anatomy of the Flosculariidæ: Professor THOMAS H. MONTGOMERY, JR., of Philadelphia.

The Earliest Differentiations of the Egg: Professor EDWIN G. CONKLIN, of Philadelphia.

In the living eggs of fresh-water snails important differentiations are recognizable before the eggs begin to divide. Soon after the formation of the polar bodies clear non-granular protoplasm accumulates at the animal pole and spreads down over the surface of the egg towards the opposite pole. About three fourths of the surface of the entire egg is covered by this clear protoplasm, which gives this portion of the egg a milky appearance, while about one fourth of the egg surface at the vegetative pole is not covered by this protoplasmic layer and is bright yellow in color. These two portions remain distinct throughout the subsequent development of the egg, the protoplasmic area giving rise to the ectoderm, the yellow one to the endoderm and mesoderm. The germ layers are, therefore visibly outlined in the unsegmented egg. In these eggs the type of asymmetry of the adult snail (whether dextral or simitral) is also predetermined, probably while the egg is still in the ovary. The chief axis of the future animal is also marked out in the egg, and is probably to be traced directly back to the egg of the previous generation. In this case, therefore, these axial relations are probably continuous from generation to generation.

Some Properties of Nickel: Mr. JOSEPH WHARTON, of Philadelphia.

A Résumé of the Composition of Petroleum from Different Fields: Professor CHARLES F. MABERY, of Cleveland.

This paper explained the composition of petroleum from different sources, and described the series of hydrocarbons that make up the great body of petroleum. In Pennsylvania oil the series C_nH_{2n+n} predominates in the lower distillates and continues to include solid paraffine hydrocarbons. Pennsylvania oil also contains the series C_nH_{2n} and the series $C_nH_{2n'-2}$, and probably also series still poorer in hydrogen in the less volatile portions.

Ohio oil has much the same composition, with the addition of the series C_nH_{2n-4}, and probably other series still poorer in hydrogen.

California oil does not contain the series C_nH_{2n+2} so far as known, but contains the other series mentioned.

Canadian oil contains all the series mentioned, with larger proportions of the series poor in hydrogen.

All petroleums contain compounds of oxygen, nitrogen and sulphur, but in variable amounts, very small in Pennsylvania oil, large in California, Ohio and Canadian crude oils.

A summary of what is known concerning the origin of petroleum was given, with some suggestions based on recent knowledge of its general composition.

SATURDAY, APRIL 4.

Morning Session, 10 o'clock.

President Smith in the chair.

A Further Classification of Economies: Professor LINDLEY MILLER KEASBEY, of Bryn Mawr, Pa.

An economy is a system of activity whereby the utilities inherent in environment are, through utilization, converted into actual utilities.

These economies can be distinguished from one another in two ways: First, according to the motive making for utilization, and, second, in accordance to the means employed in the process. They may be classified as the automatic, characteristic of plants; the instinctive, characteristic of animals; the rational, characteristic of human life.

The rational economy may be subdivided into the natural, characteristic of savages; the proprietary, characteristic of barbarians; and the commercial, characteristic of western civilization.

Some Features of the Supernatural as Represented in Elizabethan and Jacobean Plays: Professor FELIX E. SCHELLING, of Philadelphia.

The Hamites and Semites in the Tenth Chapter of Genesis: Professor MORRIS JASTROW, JR., of Philadelphia.

The Most Insidious Cause of Error in Quantitative Chemical Research: Professor THEODORE W. RICHARDS, of Cambridge, Mass.

Experiments are recorded and quoted showing that most if not all crystals deposited from solutions contain included mother liquor. The experiments show also that before this mother liquor can be eliminated by pulverization, the absorption of water from a moist atmosphere begins to augment appreciably the weight of the substance. It is pointed out that this absorption can not be overcome in the case of hydrated salts without a loss of water of crystallization also. Hence hydrated salts can not be accurately weighed according to any usual procedure. In the case of anhydrous salts the elimination of absorption is easy, but in order to remove included water the cell walls enclosing it must be disintegrated. Mechanical, thermal and chemical methods of such disintegration are classified and applied to the preparation of pure materials. It is pointed out that other impurities are usually included with the solvent in the invisible cells, and that these other impurities must never be forgotten in the course of the further purification. Finally, it is suggested that these almost infinitesimal enclosed impurities might be used as a clue to the manner of growth of natural minerals, and hence to the mechanism of geophysical processes.

The Warfare against Tuberculosis: DR. MAZŸCK P. RAVENEL, of Philadelphia.

All efforts at the eradication of tuberculosis to be successful must be based on the fundamental fact of its communicability, and in the main it is to be treated as the other contagious diseases, though the restrictions need not be so severe.

Two parties are to be considered, the tuberculous persons and the community, and while the former are entitled to every consideration and attention, the good of society in general must be the principal consideration which guides our action. Fortunately, the interests of the two parties are not irreconcilable and much can be done by education to smooth the difficulties which lie in our path.

There should be in every state and in every large city societies whose objects are the study of methods of prevention and the dissemination of such knowledge in short, plainly written tracts among the people.

In addition to this, boards of health should issue circulars constantly giving such information and advice. At present only twenty-two states and seven cities issue such circulars and recommendations, while five states have societies and five cities have local societies for the prevention of tuberculosis.

These societies can do much good also in shaping legislation. States and cities should have uniform laws regarding expectoration in public conveyances, buildings and on sidewalks; overcrowding of factories and tenement houses, the construction of such buildings as regards light and ventilation, and the employment of children under age.

Health officers should have the power to force ignorant and vicious tubercular persons who persist in reckless expectoration into hospitals provided for them by the public. There should be compulsory notification and registration of persons suffering with phthisis, and apartments occupied by such persons should be thoroughly disinfected periodically, and always after death or vacation of the premises before new tenants are allowed to enter them.

The urgent need is for institutions in which the sick can be cared for and instructed. These should be of two types—sanatoria, built in open country districts in regions known to be specially adapted to the treatment of tuberculosis, and, second, hospitals for the hopelessly ill and destitute, where the maximum of comfort can be given to them and where they will cease to be sources of infection to their families and the public in general.

In spite of the enormous expenditure which would be involved in providing hospital accommodations for the indigent tuberculous, it would cost less than the present money loss to the country from deaths alone, and in a few years we could confidently expect a marked decrease in the disease.

SCIENTIFIC BOOKS.

The Diamond Mines of South Africa. Some Account of their Rise and Development. By GARDNER F. WILLIAMS. New York and London, The Macmillan Co. 1902. Pp. 681. With 491 illustrations, 29 photogravures and 11 maps.

The most important volume that has ever appeared upon the diamond fields of South Africa, or in fact upon diamond mining in general, is that from the pen of Mr. Gardner F. Williams, General Manager of the De Beers Consolidated Mines. There is no doubt that the late Hon. Cecil J. Rhodes, who died during the early part of 1902, would have been deeply interested in this volume, and it was the desire of the author that he should see it —little realizing that this great organizer would so soon have passed away. But it must also be recognized that it was through the directing capacities and experienced mining knowledge of Mr. Williams himself that the De Beers Mines were managed in such a way that the cost of production was gradually brought down to the lowest possible limit; that theft was almost entirely done away with; and that each year had shown a decrease in the cost of production, and a greater security of these mines as an investment. To the union of these two men—one as the organizer, Mr.

Rhodes, and the other as the manager, Mr. Williams—is due a financial corporation laid out and conducted on lines of such extent and permanence that it surpasses almost any other in existence. To the credit of both be it said that they never used their positions for speculative dealings in the stock, and that neither of them ever lost faith in their great enterprise.

The title, 'The Diamond Mines of South Africa,' is slightly misleading, as the book refers only to those mines owned by the De Beers Consolidated Co., and omits some other mines in the Transvaal and the Orange Free State not under their management or ownership. These, however, represent less than three per cent. of the entire output of South Africa.

The volume opens with a chapter on the ancient Adamas, illustrations being given of all the noted historical diamonds. The second chapter treats of the traditional Ophir Land, and the facts tending to prove that the famous King Solomon's mines were in Rhodesia. To support this view, illustrations are given of the gold ornaments found in the district, and the historical evidences of the great ruins at Zimbabwe, Khami and Insiza. This theory is also sustained by John Hays Hammond, notably in a lecture delivered before the American Association for the Advancement of Science, Washington, on January 3, 1903.

It is doubtful if any one else living possesses so many facts as Mr. Williams concerning the original discovery of the African diamond mines, the early pioneers of the district and other historical data, which, if they had not been preserved here, would have been soon forever lost. These are presented in chapters III. to VII., entitled, respectively, 'The Pioneer Advance,' 'The Discovery,' 'The Camps on the Vaal,' 'The Rush to Kimberley,' and 'The Great White Camps.' These chapters give a connected and vivid account of the history of the whole region, from the Cape to the hinterland—its early settlement, its slow and scanty development through two centuries and its sudden and marvelous period of change and growth in the last thirty years.

In the 'Pioneer Advance' we have an interesting sketch of the early conditions of the Cape Colony; of the expeditions under enterprising Dutch governors and explorers, in search of the golden land of traditional Ophir, ever disappointed and turned back; of the decline of interest and of hoped-for prosperity; of the British seizure and occupation. Then follows a striking account of 'the Great Trek,' when the Boer farmers, preferring a fresh start in the wilderness to the acceptance of an alien rule, went forth to found new commonwealths on the upland veldt beyond the Vaal. The features of the country, and the strife with negro savages, are forcibly pictured; and the record, if rude, is yet heroic, and appeals very powerfully to the best traditions of our own history. After a generation had passed, in the calm, old-fashioned pastoral life of the Dutch republics, came 'The Discovery'—the first diamond accidentally picked up in the gravel of the Vaal, in 1867. In due time followed an invasion of prospectors and diamond-hunters, gathering along the valley—'The Camps on the Vaal'—the period of the 'river diggings.' Soon after came the finding of other and richer beds on the uplands to the east, and the 'Rush to Kimberley' set in, in the early 70's. This marvelous gathering, from every part of the world, is most vividly pictured, and the 'Great White Camps' that sprang up as though by magic, to give place to permanent cities and gigantic industries.

Chapters VIII. to XV. are taken up with the diamond mines themselves; chapter VIII., on 'The Opening of the Craters,' describes the early stages of mining operations, in which scores and hundreds of little private claims were worked from the surface down, until with increasing depth, the intervening roadways and then the great surrounding 'reef' or wall-rock, began to fall and cave in, so that an entire change of method was seen to be ere long inevitable. The next chapter, on 'The Moving Men,' introduces us to the history and personality, the plans, purposes, efforts and rivalries, of the two leading figures in the subsequent development of the De Beers and Kimberley mines—Cecil Rhodes and Barney Barnato—whereby was brought about

the consolidation of these extraordinary properties. Chapter X.—'The Essential Combination'—describes this result—the great achievement of Cecil Rhodes—in its history and in its bearings, both upon the mines themselves and upon the future of all South Africa.

The next chapter, on 'Systematic Mining,' gives full accounts of the methods then adopted, and now in use, for the operation of the mines in a comprehensive and economical manner. Here Mr. Williams is describing his own particular work; as the whole vast connected scheme of exploitation, under which such splendid success has been attained in the past fourteen years, and which is adapted to the further prosecution of the work for an indefinite time to come, is of his planning and execution. The modesty, however, with which he refers to himself and his unique achievements is remarkable, and bears the stamp of genuine greatness. Without the skill and ability which Mr. Williams has shown in the designing and operating of the present system, the great consolidation effected by Mr. Rhodes and his group of financial supporters might have failed of a successful result, or at least never have attained the far-reaching importance that it has.

This chapter is largely technical, and can not be readily outlined in a manner intelligible to the ordinary reader—dealing as it does of necessity with conditions, terms and processes belonging to mining engineering. In a general way, however, it may be described as a process of undermining instead of excavating. The first method had been by digging down from above, by a host of independent claim-owners, individual or corporate. The mines thus became immense pits, traversed by roads that came to stand up as narrow ridges, and walled by the vertical surrounding 'reef' of basalt and shale. As already stated, however, first the intervening roadways between the claims caved in and became useless, and then the reef-wall began to fall and cover great areas of diamond-bearing 'blue-ground' with thousands of tons of broken rock. Various tentative devices were tried for continuing the working under such conditions, but they were plainly temporary and destined to ultimate failure. Only by consolidation of all the claims could a general and comprehensive plan be adopted for operating the whole. This was brought about by Mr. Rhodes, first for the De Beers mine; next, after much contest with Mr. Barnato, by the union of this with the Kimberley mine, in which the latter had a controlling interest; then by both in cooperation, by the taking in by the great corporation, the 'De Beers Consolidated Mines, Limited,' of the Bultfontein and Du-Toits-pan mines, which together now form the wonderful group of volcanic 'necks' or 'craters' (though the latter term is hardly correct) around the city of Kimberley.

This took place in 1888; and by the beginning of 1889 Mr. Williams, as the general manager of the whole, began his new method of working. Shafts were sunk in the solid rock outside of the mine areas, and horizontal galleries run from these into the 'blue-ground' of the mines, beneath all the fallen mass that covered so much of the former workings. The blue-ground was excavated along galleries branching from these again, and thus a given area on a given level was worked out, and the overlying mass of fallen rock, its support largely removed, was allowed to sink down and fill up the empty galleries and chambers. The same process was then repeated on another level, thirty or forty feet below, and a new set of galleries opened and emptied, and whatever 'blue-ground' also had been left as supports, on the former level, was now taken out from below. It will be seen that this process admits of being carried on indefinitely downward, so far as the mechanical difficulties are concerned. The extraction is done, in each level, from the rock-wall toward the interior; and in each mine, several levels are being worked at the same time, by methods explained in the account. The extensive machinery for hoisting the material removed and for pumping out the water that accumulates, etc., is also here described and illustrated.

Chapter XII., on 'Winning the Diamonds,' is less technical than the preceding, and full of curious interest. The 'blue-ground' rock of the necks or chimneys was at first broken

up with shovels, then rudely washed and the residue picked over by hand. The various steps and stages of progress in its treatment are described, down to the wonderfully complete, rapid and accurate machine processes now employed. The rock was found to disintegrate and break up by a few months' exposure to the air, sun and rain; and thus most of the former crushing is dispensed with. The rock brought out is hauled by a very perfect system of traction to the 'floors'—large areas of smoothly rolled ground, covering several hundred acres—and there spread out, about a foot in thickness. Various processes, of steam-harrowing, occasional watering in dry times, etc., are employed to accelerate nature's effect. The removal to the washing machines, and in part to crushers, and all the devices for sorting and concentrating, are described in detail, until the last stage is reached, when the heavy concentrates are fully separated, and ready to be picked by hand. Here it appeared as though the point had been reached where machine processes had to cease and human agency alone could avail. But no! After many years of hand-picking, the discovery was made by one of the employees, Mr. Fred. Kirsten, that diamonds would adhere to grease, while the other minerals of the concentrates would not. A few experiments proved conclusive; and soon all hand-sorting was replaced by machinery—slightly inclined tables coated with a layer of grease. These are vibrated as the concentrates are made to pass over them with a current of water, and every diamond is retained, while the garnets and other heavy minerals pass on! No more simple and complete device has ever been discovered, for the saving of time, labor and loss. The diamonds thus separated are afterwards boiled in a hot solution of soda, and are then ready for the company's office and the valuator.

The succeeding chapter tells of 'Obstacles and Perils' encountered in the working of the mines, and is a graphic presentation of this aspect of the subject. The earlier dangers were chiefly from reef-falls and cave-ins; after the new methods were introduced these became unimportant. Occasional slight explosions, due to carelessness of workmen, and one disastrous fire, of unknown origin, but probably from the same cause, are described, the latter in a very vivid and feeling way. The 'mud-rushes' are the most serious liability of late; and the methods employed to prevent them are ingenious and interesting.

Chapter XIV., on 'The Workers in the Mines,' is one of great general interest, describing the conditions and regulations of life and work in the vast subterranean hive of activity, and the arrangements for housing, feeding and controlling the great heterogeneous army when above ground. About one sixth of the employees are white men, largely from the mining districts of England, though there are many Afrikanders, and a sprinkling from nearly every land on the globe. The rest, some eleven thousand, are native blacks, representing almost every tribe south of the equator, some coming from distances as great as a thousand miles. Mr. Williams gives a most interesting estimate, based on conspicuous facts, of the industrial capacity of the negro—one that impresses an American with surprise. The steadiness, persistence, contentment and capacity shown by these thousands of laborers, fresh from their native savagery, is in utter contrast to the shiftless and indolent character of the negro so largely seen in the New World, and so generally attributed to the race as such. As a sociological study this subject of the experience of the De Beers Company with African labor, on a grand scale and through many years, is worthy of most careful attention by anthropologists and philanthropists.

The moral and physical well-being of these natives are well guarded by the company in its great system of 'compounds'—walled enclosures, carefully constructed and steadily watched, where the laborers are kept in a sort of paternal confinement during their period of working. Every one engages freely for a time not less than three months, and is then at liberty to leave or renew—the great majority choosing the latter, and many remaining for years. Liquor is rigorously excluded, as ruinous to all steady or reliable service.

Good food is furnished at low rates and good wages paid. Strict sanitary arrangements are provided and maintained; and the whole of Sunday and the Saturday half-holiday, save for a little indispensable work, are granted regularly. It was found that with three shifts of men each working eight hours a day diamonds could be mined for less per head than with a twelve-hour day at the same rate of pay per day. No women may be employed in mine work, and no boys under twelve. These broad and humane provisions are an impressive object-lesson to employers and corporations not so far away.

The natural result is industry, contentment and monumental success. Much very interesting matter is given as to the ways and usages of the different tribesmen. On Sundays there is considerable missionary work done among them, and much visiting, games and music among themselves; all are cheerful and friendly, tribal enmities and feuds being excluded from the 'compound.' The native music is in itself a curious and fascinating subject, but one that can not be enlarged upon here. The De Beers compounds, however, surely present a most interesting field for study in many ways, alike in ethnology and sociology.

The succeeding chapter deals with 'The Mining Towns,' and is an account of the modern cities and suburban communities that have grown up around the diamond mines. Kimberley is described and illustrated, in its various stages, from the camp of tents and shanties of thirty-two years ago, through its next phase of brick and corrugated iron, to the up-to-date city of recent years, with its hospitals, churches, club-houses, library and school of mines, its gardens and water-works, and its refined houses surrounded with foliage and flowers. The tale is a wonderful one, though paralleled by much in our own western development, with the difference that in the case of Kimberley there is ever present as the leading factor the one great corporation, and its master-spirit, Mr. Rhodes.

Chapter XVI., on 'The Formation of the Diamond,' is the one possessing the highest interest in the book, from a scientific point of view. Both to the general reader and to those who have followed the very active discussion among geologists through some years past on this subject, Mr. Williams's full and clear summary of the facts and theories as to the whence and the how of this unique store of precious gems, will possess great interest. It may cause surprise, however, and disappointment to find that his closing word is practically that we do not know! He finds in the several theories advanced many points of striking suggestion and some of strong probability, but nothing yet that fully meets and explains the various facts encountered.

Some points are well established; others are eliminated; others still are awaiting further study. The 'necks' are in some sense volcanic chimneys, but their filling has taken place at no very high temperatures—more after the manner of mud-volcanoes than of true volcanoes; the 'blue-ground' is a breccia of fragments, and not a decomposed lava; the diamonds were not found in it, but carried up with it from below. In these conclusions Mr. Williams agrees more with the English scientists, Bonney and Crookes. On the other hand, he does not agree with Sir William Crookes in attributing to the diamonds an origin similar to the artificial diamonds of Moissan, formed from carbon in melted iron under enormous pressure and heat. Here Mr. Williams gives some facts of his own, opposed to Crookes' theory. The latter, arguing for a crystallization at great depths from molten iron, at very high temperature, had cited the explosion, or violent rupture, of African diamonds, said to occur not infrequently, as an evidence of the strain and pressure under which they had been formed. Mr. Williams states that this spontaneous breakage is exceedingly rare, and that in fact he had hardly ever met with it. He then describes some original experiments as to the presence of iron or its oxides as the coloring matter of the yellow and brown diamonds, which Crookes had cited as an evidence of their origin from fused iron far down in the earth's crust. 'These experiments were made upon a magnetic separating machine, the field magnets of which attracted any mineral which

contained iron in a metallic or oxidized state'; but no slightest response was shown under the most powerful action of the machine, and with diamonds of the most marked yellow and dark tints. If they contain iron at all, its amount must be infinitesimal.

That the 'blue-ground' is not a decomposed lava, and has not been greatly heated since the diamonds have been in it, is shown by experiments of Herr Luzi, at Leipsic (*Ber. d. Deutschen Chem. Gesell.*, 1892), which are here described, but which have not attracted the attention that they deserve. He fused some of the 'blue-ground' in a graphite crucible at 1770° R. (4014° F.) and then introduced a diamond crystal, and closed and reheated the crucible. The diamond, previously smooth and brilliant, was found to have been corroded and etched, *i. e.*, partially dissolved, by the fused silicate mixture, in which it had been originally embedded. Mr. Williams then asks, How is it possible that most of the crystals found are bright and polished, with no trace of such corrosion, if the blue-ground has ever been in any condition of fusion from heat, like a lava.

The latest reference of the diamonds to an origin in an eclogite rock at very great depths, suggested by Professor Bonney, in consequence of some having been found enclosed in boulders of that rock in the blue-ground of the Newland's mine, is duly considered, and some questions raised in regard to it by Professor Bonney himself are stated. Mr. Williams expresses no positive opinion as to this view, the facts observed at the Newland's mine not having come under his notice at De Beers or Kimberley; and, as before stated, his latest word is non-committal.

The next two chapters, on 'The Diamond Market' and 'Cutting and Polishing,' are abundantly interesting, but can not be enlarged upon in this sketch. Suffice it to say that they are full and accurate accounts, freely illustrated, of all the methods of assorting and valuing the diamond-product, together with notes on the other diamond regions of the world and on the sale and distribution of the stones in commerce; and in the eighteenth chapter, of the history and development of the art of cutting, and of the present methods and principal seats of the industry.

The closing chapter, 'An Uplifting Power,' is a remarkable presentation, from the Rhodes-De Beers standpoint, of the influence of the great diamond fields on the development, progress and civilization of the Dark Continent. The opening of mines; the building of cities; the laying out of railroads; the conversion of an arid wilderness into a populous and progressive land of civilized institutions; the repression of bloody tribal warfare; and the extension of British control and influence far toward the equator, and ultimately, in vision, 'from the Cape to Cairo'—all these have resulted largely from the Kimberley discoveries. They were the dream and the ambition of Mr. Rhodes, who bent all his truly wonderful energies toward their accomplishment, seeking wealth and power, as Mr. Williams emphatically contends, not as ends in themselves, but as means to the realization of a grand historical idea. The account is both impressive and inspiring, and evidently contains a large amount of truth. Of the other and darker side, nothing is said; the 'Jameson raid' is not mentioned and the recent war is but slightly alluded to, save in the account of the siege, in the appendix, and then only in its local incidents. It is but just to Mr. Williams, however, to recall that he is writing about the De Beers mines, and not about the history of South Africa in general, though the two are closely connected, as he himself has shown. His estimate of Mr. Rhodes is exceedingly high and his sympathy with him is profound, but he writes in a spirit of great breadth and fairness that impresses the reader very favorably.

The volume closes with an appendix, of which the first part is a history of the siege of Kimberley. This is a most vivid and even thrilling account of the four months' investment; the conversion of the mine-workers into a garrison, and of the tailing-heaps into redoubts; of the turning of all the machinery and resources of the great mining plant into one and another means of defense; of the ever-ready energy of Mr. Rhodes to meet new

emergencies as they arose, which were often beyond any means of military or official solution.

The remaining parts of the appendix give detailed statements about the winding engines, pumping plant and the relative value and efficiency of various coals, African and English; and the last section gives a tabular statement of the yield of the mines, year by year, since the consolidation in 1888. This is a most remarkable body of statistics, well worthy of careful examination.

The report volume would be much more valuable if a single good map of the region dealt with so extensively in all the historical chapters accompanied it. Two or three little maps of special localities, and one of the railroad systems, in part, are all that are given. The book has a good index, but is wholly lacking in a table of contents, either at the beginning of the volume or at the head of each chapter. This again is a great defect.

Mr. Williams has written a great book that reads like a romance; and the tale of Sinbad the Sailor and his valley of diamonds is as nothing compared with the story of the discovery of mines which up to the present have produced more than $500,000,000 worth of uncut diamonds—with little diminution of the output in sight to-day; of the building of cities and railroads in the wilderness; of mines equipped with machinery made in Chicago and London—machinery that is almost human in its accuracy. The literature quoted in the volume is an admirable exposition not only of the history of the mines, but of the entire South African region. From the finding of the diamond by the children of Samuel Jacobs, the handing of the crystals by van Niekerk to a traveling trader, John O'Reilly, and the identification of it by Lorenzo Boyes, to the working of a shaft to a depth of 1,400 feet, is a story without parallel. The wonderful finding of the diamond on the Vaal River on the Gong Gong, and discovery at Kimberley only a few years later, are described so vividly as to have an interest such as few works on travel afford us. Here we have also the story of the thousands of claims that seventeen years later were consolidated into a great corporation through the genius and organizing powers of Cecil J. Rhodes.

The discovery of diamonds in South Africa has done more to open up that country than all other industries together, for it was the encouragement from the sale of diamonds that precipitated the Matabele war which led to the discovery of gold in the Transvaal, in value many times exceeding that of the diamond fields of the region. The change from a multitude of individual claims, that gave the district the appearance of gigantic ruins, to the working by the shaft system was organized under Mr. Williams's administration. The employment of contract and native labor, the latter often obtained more than 1,000 miles from the mines, and the utilization of the most approved mining machines, replacing the old wheelbarrows and cradles of the earlier days, meant that the cost of mining diamonds was reduced to a fraction of what it was before, and that there was nothing to be feared from the lowering of the price by dealers who purchased stolen material. When we realize that South Africa has recently produced in one decade more than ten times the value of all the diamonds ever found in Brazil, and that this immense production dates from the discoveries begun in 1867, we may realize in a slight degree how great a change has taken place in the world's diamond production within the lifetime of a single generation.

GEORGE F. KUNZ.

Vergleichende chemische Physiologie der niederen Thiere. Von Dr. OTTO VON FÜRTH, Privatdocent und Assistent am physiologisch-chemischen Institut der Universität Strassburg. Jena, Gustav Fischer. 1903.

The progress which recent years have contributed in the study of the comparative morphology and physiology of animals has largely been emphasized along non-chemical lines. This is due not so much to an absence of chemical data which are of interest and importance in animal biology as to the difficulty which the student has experienced in collecting and correlating what has already been ascertained in this direction. There is no

dearth of observations which may be expected to throw light on the chemical reactions and metabolic processes of the lower animals; but they are scattered so widely through the literature, and they appear so isolated in their bearing, that an adequate systematic presentation of the comparative chemistry of animals has never been attempted before the publication of the book by Dr. von Fürth. Indeed, it must be acknowledged that few individuals have acquired the wide biological experience and chemical training which are demanded for the successful accomplishment of such a task.

In the opinion of the writer, Dr. von Fürth's book is one of the most important recent additions to the literature of physiological chemistry. Its value lies not only in the compilation of an orderly digest of an enormous number of scientific papers, most of which have apparently been consulted in the original; equally satisfactory is the critical attitude which has been assumed in editing the heterogeneous experimental material. And it is, perhaps, not so much in the classification of facts and the orderly treatise on comparative physiological chemistry, as in the exposition of the deficiencies of our knowledge, that the biological investigator will find the work helpful and stimulating. In almost every chapter the author has pointed out lines of experimental inquiry—biochemical problems which demand solution. What has already been attained makes it clear that we may expect still greater advances in biology to follow the more extensive application of comparative chemical methods in this domain. A review of the current text-books will readily convince one upon what slender basis many chemical considerations, handed down without verification from writer to writer, really rest. As von Fürth remarks, too many have contented themselves with the principle:

"Nur muss man sich nicht allzu ängstlich quälen;
Denn eben wo Begriffe fehlen,
Da stellt ein Wort zur rechten Zeit sich ein.
Mit Worten lässt sich trefflich streiten,
Mit Worten ein System bereiten,
An Worte lässt sich trefflich glauben,
Von einem Wort lässt sich kein Iota rauben."

New experiments and fresh facts are wanted; and the encouragement which this volume offers will bring results. When, for example, the physiological chemist shall be able to differentiate the proteid substances according to their chemical structure—a possibility which recent advances make by no means improbable—then we may truly group like with like and classify protoplasmic masses according to their chemical make-up. Then we may hope to accomplish along chemical lines also what the morphologists have long attempted with much success in determining the biological relationships of animals. In merely pointing out the gaps in our present knowledge von Fürth has done a useful service.

Von Fürth's book is not adapted to detailed review in this place. In an introductory chapter a résumé of the essential features of organic chemistry and of the physiologically important types of organic compounds has been given with unusual success. This will be a welcome recapitulation to the biologist unaccustomed to thinking in chemical ways. Succeeding parts deal with the chemical composition of protoplasm, the blood, respiration, nutrition, excretion, animal poisons, specific secretions, the muscles, the connective tissues, reserve and skeletal constituents, products of the sexual glands, and the chemical environment of animals. In each chapter an introductory historical sketch leads to detailed consideration of the topic in connection with the various groups of the invertebrates. The references to the literature are given in detail, experimental methods being included in many cases.

The completion of a task such as von Fürth has accomplished so well should not be made the occasion for unfavorable criticism. A number of typographical errors, aside from those noted in the appendix, remain uncorrected. It seems unfortunate that in Strassburg the work of American physiologists is still cited and known only through German abstracts. Dr. von Fürth deserves congratulation for his contribution to biochemical literature.

Lafayette B. Mendel.
Sheffield Scientific School,
Yale University.

SCIENTIFIC JOURNALS AND ARTICLES.

THE *Bulletin of the Torrey Botanical Club* for February contains a paper 'On Atavistic Variation in *Œnothera cruciata*,' by Hugo de Vries; 'Nova Ascomycetum Genera Speciesque,' by Frederic E. Clements; 'New Species of Fungi,' by Charles H. Peck; 'A Fossil Petal and a Fossil Fruit from the Cretaceous (Dakota Group) of Kansas,' by Arthur Hollick; 'Notes on Antillean Pines, with Description of a New Species from the Isle of Pines,' by W. W. Rowlee; 'The Polyporaceæ of North America, II., the Genus *Pyropolyporus*,' by William Alphonso Murrill; and the usual instalment of the 'Index to Recent Literature relating to American Botany.' The March number consists mainly of 'Studies in Plant Hybrids: The Spermatogenesis of Hybrid Cotton,' by William Austin Cannon, but includes a biographical sketch of Dr. Timothy Field Allen by N. L. Britton; 'Studies in the Asclepiadaceæ—VII., A New Species of *Vincetoxicum* from Alabama,' by Anna Murray Vail; 'A New Species of *Waldsteinia* from Idaho,' by C. V. Piper; and the 'Index to Recent Literature.'

THE February number of *Torreya* contains 'Notes on Southern Ferns,' by L. M. Underwood; '*Trichomanes Petersii* Found Anew,' by A. B. Seymour; 'A Unique Climbing Plant,' by Roland M. Harper; 'An Undescribed *Eleocharis* from Pennsylvania,' by N. L. Britton, and 'A Key to the North-American Species of *Stropharia*,' by F. S. Earle. Carlton C. Curtis reviews Kraemer's 'Course in Botany and Pharmacognosy,' and this is followed by the 'Proceedings of the Club' and news items.

Torreya for March includes 'Vital Persistency of *Agave Americana*,' by S. B. Parish; 'A Key to the North-American Species of *Lentinus*—I.,' by F. S. Earle; 'The Pubescence of Species of *Astragalus*,' by Francis Ramaley; 'Insect Visitors of *Scrophularia*,' by T. D. A. Cockerell; and 'Some Interesting Hepaticæ from Maine,' by Caroline Coventry Haynes. C. C. Curtis reviews MacDougal's 'Influence of Light and Darkness upon Growth and Development,' and the number is completed by the 'Proceedings of the Club' and news items.

SOCIETIES AND ACADEMIES.

THE NATIONAL ACADEMY OF SCIENCES.

THE following papers were either read or presented by title at the stated session of the National Academy of Sciences held at Washington on April 21, 22 and 23:

HENRY F. OSBORN: 'An Estimate of the Weight of the Skeleton in the Sauropoda, or in the Sauropodous Dinosaurs.'

HENRY F. OSBORN: 'New Characters of the Skulls of Carnivorous and Herbivorous Dinosaurs.'

HENRY F. OSBORN: 'Models illustrating the Evolution of the Amblypoda, also of the Dinosaur *Diplodocus*, together with a Theory as to the Habits of the Sauropoda.'

GEORGE F. BARKER: 'Radioactivity of Thorium Minerals.'

J. M. CRAFTS: 'The Law of Catalysis in Concentrated Solutions.'

J. M. CRAFTS: 'The Standardization of Thermometric Measurements.'

GEORGE E. HALE: 'The Rumford Spectroheliograph of the Yerkes Observatory.'

LEWIS BOSS: 'The Determination of Standard Right-ascensions free from the Personal Equation for Star-magnitude.' (With stereopticon illustrations.)

R. A. HARRIS: 'On the Semi-diurnal Tide of the Northern Part of the Indian Ocean.' (Introduced by Cleveland Abbe.)

ARTHUR L. DAY: 'The Melting Point of a Simple Glass.' (Introduced by G. F. Becker.)

THEODORE GILL: 'Biographical Memoir of J. E. Holbrook.'

GEORGE F. BARKER: 'Biographical Memoir of Matthew Carey Lea.'

S. F. EMMONS: 'Biographical Memoir of Clarence King.'

JEFFRIES WYMAN: 'Biographical Memoir of A. A. Gould.' (Read by W. H. Dall.)

CHARLES S. HASTINGS: 'Biographical Memoir of James E. Keeler.'

CARL BARUS: 'The Diffusion of Vapor into Nucleated Air.'

H. P. BOWDITCH: 'Biographical Memoir of Theodore Lyman.'

ALEXANDER AGASSIZ: 'The Nomenclature of the Topography of the Bottom of the Oceans.'

S. Weir Mitchell: 'On the Discovery of an Antidote for Rattlesnake Poison.'

Alex. Graham Bell: 'On the Tetrahedral Principle in Kite Structure.'

BIOLOGICAL SOCIETY OF WASHINGTON.

The 370th meeting was held on Saturday, April 4.

H. J. Webber discussed 'Bud Sports and Bud Variation in Breeding.'

The speaker called attention to the very numerous cases of bud sports which have been described in literature and discussed a number of instances that had come under his personal observation. All parts of a plant, it was pointed out, may exhibit this phenomenon; in some cases almost the entire plant shows the change, while in others the variation is limited to a single fruit or flower or a segment of a fruit or portion of a flower.

Many cases seem unquestionably to be instances of reversion to some ancestral type, while in other cases the change would seem to be attributable to another cause. The writer outlined an hypothesis accounting for the occurrence of such bud sports as segregation changes in the division of meristematic cells in the bud. In plants of mixed or hybrid origin a segregation of the pangens or anlagen representing an allelomorph, or character pair, was presumed to occur in certain somatic cells resulting in a separation of the anlagen, as in the case of the pollen and egg cell formation of first generation hybrids, following Mendel's hypothesis. In the case of the appearance of new characters the speaker assumes that here, and also in the case of hybrids, the new combination of pangens representing various characters results in the formation of a new crystallization, as it were, which appears as a new character.

Rodney H. True described 'The Manufacture of Tea in America,' illustrating his remarks with lantern slides. He stated that all varieties of tea plant used in American experiments belonged to one botanical species, the class of tea, green, black or oolong, being in large measure the result of factory treatment.

There are present within the tea leaf tannin and oxidizing enzymes, which on uniting form a reddish-brown product, allied to the class of bodies known as phlobaphenes.

In the making of green tea the leaves are so dried as to destroy the oxidizing enzymes before they react with the tannin, thus retaining the green color of the leaf. The application of heat is the usual method of destroying the enzymes. Light exerts also a destructive influence on this class of bodies.

In making black tea any process hindering the reaction between the tannin and oxidases is avoided until the fermentation has been completed. The high temperature attained during the final firing destroys the oxidases and prevents further fermentation.

Oolong teas represent a class in which the action of the oxidases on the tannin has been begun, but has been stopped before full fermentation has taken place.

Owing to the fact that various varieties of tea contain oxidases in varying quantities, the readiness with which black tea can be made from these varieties is also variable.

W. C. Kendall spoke on 'The Trouts of the Rangeley Lakes,' saying that the fish fauna of these waters was poor in species, although the lakes were renowned for the size of their brook trout, examples of which reached a size of from nine to eleven pounds. The trout was now extinct in Lake Umbagog, and while the blame of this was laid on the pickerel, there were reasons for believing that the pickerel was not wholly, if at all, to blame. The speaker stated that while it had been denied that the Rangeley trout were decreasing, yet such was the case, and that the angler was probably to blame for it by the introduction of the landlocked salmon. This fish made additional demands on the small food supply, introduced a competitor to the trout and, possibly, an additional enemy. Mr. Kendall then discussed the blue-backed trout, *Salmo oquossa,* a species supposed to be peculiar to the Rangeley Lakes, and noted that this fish had become rare within the last few years, although those taken were much larger than the average size of this trout. The possible reasons for the decrease were considered, and

it was stated that possibly *Salmo oquossa, S. oquossa marstoni,* and *S. alpinus aureolus* might prove to be different forms of one species. F. A. LUCAS.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

THE 176th regular meeting was held on March 12, 1903, fifteen members and three visitors present. Mr. W. D. Kearfott, of New York City, was elected a corresponding member, and Messrs. H. E. Burke and J. L. Webb, of the Bureau of Forestry, U. S. Department of Agriculture, active members.

Mr. Busck announced that a collecting excursion to Bladensburg had been planned for the 26th of March.

Mr. Ashmead exhibited two wasps from Trong, Lower Siam. The first, *Vespa dorylloides* Saussure, superficially resembles the male of *Dorylus,* a genus of large ants. It appears to possess characters which differentiate it from *Vespa* and justify placing it in a new genus. The other specimen belongs to the genus *Ischnogaster.* This genus, though classified with the Eumenidæ, a family composed mostly of forms which are solitary in habit, is nevertheless said to be represented in India by social species. Mr. Ashmead showed, also, a specimen of the large Japanese wasp, *Vespa mandarinia* Smith, now placed in Thomson's genus *Vespula.*

Dr. Dyar presented a short paper entitled 'Note on *Crambus offectalis* Hulst and Allied Forms.' A specimen from New Mexico, confused with *offectalis,* is described as a new species of *Evetria.*

Mr. Barber read a letter written from Cuba by Mr. E. A. Schwarz, containing much interesting entomological matter. Dr. Howard stated that Mr. Schwarz had found what may prove to be the original food plant of the cotton-boll weevil (*Anthonomus grandis* Boheman), namely, the wild 'kidney cotton' (*Gossypium brasiliense?*)

Dr. Hopkins read extracts from letters reporting a recent very destructive outbreak of the 'pine bombyx' (*Dendrolimus pini* Linnæus) in the redwood forests in Norway. Until the past season the moth has not occurred there in sufficient numbers to cause serious damage since the outbreak of 1812 to 1816.

Dr. Dyar reported some early dates for the hatching of mosquito eggs. Eggs of *Culex canadensis* in his possession had hatched on the 9th of March, while at Lahaway, New Jersey, Mr. J. Turner Brakeley had found larvæ under the ice in February.

Mr. Banks showed a nest of the 'purse-web spider' (*Atypus abboti* Hentz) which he had found at Falls Church, Virginia. The species is rare here, though known as far north as Massachusetts.

Dr. Dyar presented a paper entitled 'New North American Lepidoptera, with Notes on Larvæ.'

Mr. Busck showed specimens of a buff and gold colored form of the codling moth (*Cydia pomonella* Linnæus), describing it as *simpsonii,* new variety.

Mr. Currie read a paper on 'The Odonata (dragonflies) Collected by Messrs. Schwarz and Barber in Arizona and New Mexico.' This collection, he stated, contained twenty-four species and two varieties. One species, an *Ischnura,* proved to be new.

Under the title 'Some Remarks on Japanese Hymenoptera' Mr. Ashmead commented upon the Japanese species in the U. S. National Museum. The Aculeata, he said, belonged mostly to described species, but in the Parasitica there were probably 150 new species. He believed there were in the neighborhood of 500 described Japanese Hymenoptera.

ROLLA P. CURRIE,
Recording Secretary.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 564th regular meeting was held February 28, 1903.

Mr. C. G. Abbot presented an elaborate approximate method for the quadrature of the circle, recently furnished by a correspondent of the Smithsonian Institution.

Mr. C. F. Marvin then spoke on 'The Seismograph.' He said the first instruments were crude and effective. The earthquake in Japan in 1880 led to the formation of a seismological society (among the first members of which were two of our own members,

Messrs. Mendenhall and Paul) and to the development of the modern type of instruments. A large instrument was exhibited of the 'inertia-type,' in which a heavy suspended mass serves as a fixed point for attachment of levers, the distant end of which carries a recording point, while a frame subject to any earth-tremors engages the levers at an intermediate point. Professor Newcomb described briefly the instruments shown him during the past summer at Göttingen.

Dr. A. L. Day then, with the aid of lantern illustrations, presented the modern view of 'Black Bodies' and the great developments that had followed the introduction of the hollow internally reflecting and radiating shell, whose radiations reached an outside instrument through a small hole in the wall. Such a body is theoretically more perfectly 'black' and practically more permanent and manageable than any body that is black to the eye. The methods of estimating the temperature of a highly heated body from the nature of its radiations were pointed out.

At the 565th meeting, held March 14, 1903, the death, on February 28, of Professor William Harkness, formerly the president of this society, was announced.

On the call for informal communications Professor Cleveland Abbe exhibited a collection of half-tone plates of snow-crystals just published by the Weather Bureau. The original photomicrographs were selected from the enormous collection of plates taken by Mr. Bentley, of Jericho, Vt.

The first regular paper had been announced to be by Mr. Gilbert T. Walker, of England, on 'Boomerangs'; but he was unable to appear, owing to a strain received in the afternoon during a public exhibition of his remarkable skill in designing and throwing these weapons. In his absence there was a general discussion of the subject and of his demonstrations. Attention was called to his papers on the subject in Science and the 'Smithsonian Report' for 1901.

The new Baldwin computing machine, made in the United States, and put on the market by the Spectator Company, of New York, was exhibited and explained by Professor Marvin. Speaking generally, it is similar in principle and capacity to the long-known Thomas machine, but is more compact and differs in nearly all its details.

Mr. George R. Stetson then read a paper on 'The Genetic Problem of Typography.' He outlined the various claims made for Coster, Fust, Guttenberg and Schoeffer, emphasizing the great difficulty of finding sufficient evidence to establish priority with certainty, and pointing out the very divergent conclusions to which the principal writers on this history have come. He concluded with a description of the Plantin Museum of Typography at Antwerp.

Charles K. Wead,
Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

January 19, 1903.—Mr. W. L. Sheldon presented a summary of the progress in the science of ethics, since the publication of Darwin's 'Descent of Man,' in 1871.

Two persons were elected to active membership.

February 2, 1903.—Dr. Tarleton H. Bean delivered an illustrated lecture on 'The Salmon and Salmon Fisheries of Alaska.'

Dr. R. J. Terry reported on a case of right aortic arch in man—of relatively rare occurrence—and by the aid of lantern slides and blackboard diagrams indicated its peculiar features and morphological significance with reference to the circulatory system of the embryo and of adults in lower groups of vertebrates.

One person was elected to active membership.

February 16, 1903.—Professor A. W. Greeley gave an account of experiments on protoplasm of variations in temperature and water contents, in which it was shown that in the case of certain algæ and protozoa, and in the eggs of some of the marine invertebrates, a reduction of temperature gave rise to parthenogenetic spore formation or egg segmentation, as was also the case when water was plasmolytically withdrawn from the cells.

One person was elected to active membership.

March 2, 1903.—Professor F. E. Nipher gave an account of his experiments in the production of ether waves by means of explosions. He is now using a brass tube, six feet long and one and one third inches in diameter, for the explosive, which is laid in a train from end to end. This tube is placed within a large brass tube, one and three eighths inches in diameter, which is wound with 25,700 windings of No. 25 copper wire. This coil is connected with a delicate D'Arsonval galvanometer. The coil is placed with its axis in the magnetic meridian. When gunpowder is exploded in the inner tube, the galvanometer gives indication of a change in permeability of the heated channel within the coil. The results were said to be as yet inconclusive, and the apparatus is to be somewhat modified, with a view to making it more sensitive.

March 16, 1903.—Dr. H. M. Whelpley gave an illustrated account of the sacred pipe-stone quarries of the upper Missouri.

April 6, 1903.—Professor A. S. Chessin presented a communication on the strains and stresses in a rotating thin circular disk.

Professor F. E. Nipher reported that he had apparently succeeded in producing a distortion of a magnetic field by means of explosions. The apparatus used was a transformer consisting of concentric coils wound upon brass tubes. The outer tube was five inches in diameter and six feet long, wound with over four thousand windings of No. 16 wire. This coil was traversed by a continuous current from a storage battery. Within this, and separated from it by an air-space of an inch, is a secondary coil of equal length having over twenty-five thousand windings of No. 25 wire. This coil is connected to a D'Arsonval galvanometer. Within the tube on which this coil is wound is a smaller brass tube, within which a train of black gunpowder is laid. This tube is open at both ends, and has practically no recoil when the explosion is made. When hung by a bifilar suspension on cords ten feet in length, the recoil is about an inch. When the exciting current is small compared with the capacity of the battery, the galvanometer reading is very steady. When the train is exploded, a sudden and marked throw of the galvanometer results, which could be accounted for by an increase in the permeability of the long explosion chamber. The deflection reverses when the field in reversed. The hot gases liberated in the explosion are all diamagnetic, and tend to decrease the observed effect. In two cases the galvanometer deflection was in the opposite direction from that stated above, and this is being further inquired into. When seven tubes between the two coils are simultaneously exploded, only slight effects could be obtained, and these deflections are wavering, or to and fro, in character. A wire was threaded through the inner combustion tube, through which a current of three ampères was passed. This circuit was opened and closed with no visible effect. The galvanometer circuit is shielded by tin-foil, which is also connected with the explosion tube, and grounded. Sparks an inch long to the tin-foil produce no result. When the explosion tube is removed from the transformer, and taken near the galvanometer, or the storage battery, no deflection is produced by the explosion.

An explosive mixture of gases from water electrolysis under atmospheric pressure produces a much less violent explosion, and produces a correspondingly less effect. The scale reading of the galvanometer changes by over twenty divisions with the heaviest explosions and an exciting current of 0.6 ampère. With smaller explosions or feebler currents, the effect is diminished. No deflections can be produced by striking the table upon which the transformer rests, nor by striking the transformer itself, even when it moves slightly under the blow. The secondary and primary coils are held rigidly in fixed position with respect to each other.

Arrangements have now been made to place the explosion tube in the focal line of a parabolic cylinder of metal, the galvanometer coil being in the focal line of a similar mirror. Either or both are to be surrounded by an exciting coil.

This line of research was suggested by Young's account of his observation of five

solar outbursts in 1872, which were each accompanied by sharp fluctuations in the magnetic tracings at Kew and Stonyhurst. Since the experiments began, volcanic explosions have produced such ether waves, which have been simultaneously recorded over the continents of Europe and America.

Mrs. Eliza McMillan and Mr. Wm. Northrop McMillan, the donors to the academy of a home, as noted elsewhere, were elected patrons of the academy.

William Trelease,
Recording Secretary.

DISCUSSION AND CORRESPONDENCE.

THE FIRST USE OF THE WORD 'BAROMETER.'

To the Editor of Science: I quite agree with Dr. Bolton's conclusion that Robert Boyle introduced the word 'barometer' into our language about the year 1665 (Science, p. 548). Although Dr. Bolton finds that the first use of the word by Boyle was in the *Philosophical Transactions* of 1666, yet he suspects him to be the author of an anonymous communication to that journal the previous year, in which the 'suspended Cylinder of Quicksilver' was called a 'Barometer or Baroscope.' For conclusive proof that Boyle really used these terms in the year 1665, I would cite a work that appears to have escaped Dr. Bolton's notice, viz., 'The General History of the Air * * * by the Hon. Robert Boyle, Esq.,' published in London in 1692, which contains 'A short Account of the Statical Baroscope, imparted by Mr. Boyle, March 24, 1665.' In this letter to Mr. H. Oldenburgh, Boyle describes the instrument as some large and light glass bubbles, counterpoised in a pair of scales, and placed near a 'Mercurial Baroscope' (also called a 'Barometer' in the same letter), from which he might learn the present weight of the atmosphere. The same work contains probably the earliest systematic register of thermometer, barometer, hygrometer, wind and weather in England, viz., that kept by J. Locke, the philosopher, at Oxford and at London, between 1666 and 1683, with interruptions. The reading of the mercurial barometer, designated at first 'baroscope,' was recorded in inches and tenths, but in another register, kept at Townley, in Lancashire, during a portion of the years 1670 and 1671, it was recorded to hundredths of an inch.

Professor G. Hellmann, the eminent German meteorological bibliographer and historian, although cognizant of Boyle's 'General History of the Air,' seems to be unaware of the letter quoted, since he also states in the introduction to No. 7 of his 'Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus' that the word 'barometer' was first used by Robert Boyle in 1666, whereas it is certain, from what I have shown, that Boyle had already employed it the year before. A. Lawrence Rotch.

Blue Hill Observatory,
April 13, 1903.

SHORTER ARTICLES.

A PRELIMINARY ACCOUNT OF THE EXPLORATION OF THE POTTER CREEK CAVE, SHASTA COUNTY, CALIFORNIA.

The Potter Creek cave lies in a belt of gray Carboniferous limestone, about a mile southeast of the United States Fishery Station on the McCloud River at Baird, Shasta County. The mouth of the cave is situated in a bluff on the north side of Potter Creek, at an elevation of 1,500 feet above sea level, and about 725 feet above the McCloud.

The existence of bones in the cave was first discovered in 1878 by Mr. J. A. Richardson, who found there the skull of a large extinct bear afterwards described by Professor Cope as *Arctotherium simum*.* This specimen is now in the Cope collection at the American Museum of Natural History, New York.

The cave was rediscovered by Mr. E. L. Furlong, of the University of California, in July of the past year. Mr. Furlong penetrated the deposit on the floor of the main chamber, with the result that a large number of bones representing a Quaternary fauna were found in a series of stratified deposits of pebbly clay, cave breccia, stalagmite and volcanic ash. On Mr. Furlong's return to

* Cope, *Am. Nat.*, XIII., p. 791; XXV., pp. 997–999, Pl. XXI.

Berkeley the exploration was continued by the writer.

The work of excavation has been generously supported by Mrs. Phoebe A. Hearst as a part of the investigation being carried on with a view to determining the antiquity of man in California, and has been conducted under the direction of Professor J. C. Merriam. Through the kindness of Dr. W. C. Bruson and Mr. D. P. Doak, the controllers of the property, a lease has been secured, and the deeper portion of the cave will be explored during the coming summer.

The system of galleries which comprises the Potter Creek cave extends in a northwest-southeast direction, in a general way parallel with the strike of the limestone. The floor of the principal chamber is 42 feet beneath the opening communicating with the winding passage leading to the exterior. It can be reached only by a vertical rope ladder secured above to a convenient stalagmite pillar. This chamber has a length of 106 feet and is 29 feet wide at its widest part. It narrows to a width of four feet at the extreme northwest end. Both walls slope toward the west, the west wall overhanging. The vaulted roof rises at least sixty feet above the floor. Numerous massive pendants ornament the hanging wall.

The floor of the large chamber was of pebbly clay and cave breccia. The main deposit was in the form of an alluvial fan with its apex in the narrow northwest end. The surface of the fan was in general convex, flattening somewhat toward the center of the chamber. A thin superficial layer of stalagmite was present on the margin of this deposit adjoining the west wall. In the southeast end there is also a fan, rising almost as high as the one just described. The surface of this slope down almost to the lower edge is covered with a firmly compacted cave breccia and is strewn with large fallen blocks of limestone and broken stalactites.

Work was begun in the clay about the middle of the main chamber, near the margin of the northwest fan, and was carried toward the northwest end. The surface of the deposit was staked out in four-foot squares, and each of these sections was worked in ten-inch levels, all the specimens from each level being labeled with the number of the section and the depth at which they were found.

The structure of this fan was as follows, in descending order:

A. Pebbly clay with gravel lenses, 4 to 13½ feet.

B. Persistent gravel stratum, 6 inches to 1½ feet.

C. Volcanic ash, up to 1½ feet.

D. Clay with fallen limestone blocks, up to 3 feet.

E. Stalagmite cementing angular blocks of limestone (false floor), 18 inches or more.

The pebbly clay (stratum A), is a reddish clay similar to that produced by the subaerial decay of the limestone and intrusive diabase. It contains abundant angular fragments of blue limestone and occasional pieces of stalactite from the roof. This deposit varies in thickness from four feet to thirteen and a half feet. A layer of stalagmite partly capping this reddish earth on the west margin rarely exceeds a few inches in thickness, usually averaging from half an inch to an inch. It is closely associated with the pendants fringing the west wall, and has been largely deposited by water dripping from them.

Beneath the capping stratum of clay, two main gravel lenses are distinguishable. These roughly parallel the surface of the fan and feather out toward the northwest margin. The gravel strata, so called, are composed of angular, drip-washed limestone fragments, and could readily be formed by water falling from the roof and washing the small limestone fragments out of the clay. These strata vary from three or four inches to a foot and a half in thickness. On approaching the west wall, the gravel lenses were in some cases found to coincide with sheets of stalagmite. The gravel strata are separated by beds of clay, similar in every respect to the first clay stratum described. On the disappearance of the gravel all these clay strata blend.

Beneath the persistent gravel layer (stratum B) is a deposit of fine particles of volcanic glass (stratum C), which appear to have drifted into the cave by wind action in Qua-

ternary time and to have been deposited in a small body of standing water. The prevailing color of the ash is an ocherous yellow, but some samples have a brownish tint. The deposit varies from a fraction of an inch to a foot and a half in thickness, thinning out toward the northwest and southeast margins. At the former margin it is seen to dip about five degrees toward the southeast. Throughout it is well stratified and shows little mixture with foreign material. Chemical analysis shows the glass to contain 63.69 per cent. of silica. This indicates that the ash is either andesitic or trachytic, with the probability in favor of the former. Its source has not been determined. It was probably derived from some of the volcanoes of the Cascades, perhaps from Lassen Peak or Shasta.

Stratum D, beneath the volcanic ash, is a clay layer varying from a small fraction of an inch to three feet in thickness. It commonly contains angular boulders of limestone and large pieces of stalactite. More or less stalagmitic cementation is locally present.

Excavation ceased temporarily at the surface of a hard sheet of breccia (stratum E), which lay beneath the last-mentioned clay. This breccia sheet was penetrated at one point, where it was found to be eighteen inches thick.

During the excavation there was discovered a circular series of chambers not before visible. The opening leading to these chambers was in the west wall of the main cave and was buried beneath about eleven feet of stratified deposits. The northwest gallery of this new series contains a stream of earth derived from that in the main cave. The top of this fan, at the entrance, is level with the top of the hard breccia floor (stratum E). It slopes steeply to the west and has the greater part of its surface covered with white crystalline stalagmite. Near the entrance the stalagmite contains imbedded bones. Bones were also scattered at irregular intervals down the slope.

The materials forming the various deposits above the hard breccia floor (stratum E) have been derived largely from external sources. The stratigraphy of the fan excavated shows that the greater part of its material entered the cave from the outside through a narrow fissure in the limestone, which can still be seen, choked with earth, forty feet above the apex of the fan. From this fissure, earth and bones fell through a chute-like opening to the floor below. The earth in the westerly lying series of galleries has entered from this same source, sliding to the west as the bottom of the main chamber filled. All the bones in the west galleries are older than those occurring above the stratum of volcanic dust in the main room. The volcanic material, in undisturbed position, lay about two feet above the entrance to these galleries. The fan in the southwest end has also been derived largely from external sources, entering through an opening similar to that already described. In addition to these openings and the existing entrance to the cave, there have probably been others which are more or less completely closed by the formation of calcite growths.

Although the cave seems to have been formed along a fissure by percolating water removing the limestone in solution, so far as explored, nothing approaching a residual cave earth has been found in place in the lower chambers. There is no evidence to prove that the cave has been excavated by stream action. A few stream-worn pebbles have been found in the lenses of drip-washed limestone fragments, but, like the majority of the bones, these pebbles have fallen into the cave from without, and have not been rounded by water action in the cave.

Bones were found in all the strata explored excepting the volcanic ash. In all cases they have lost their organic matter completely. In the superficial layers of the clay stratum they are commonly blackened, but at deeper levels they are white and quite brittle. In the gravel lenses scattered teeth and small bones of various rodents are particularly abundant. A large percentage of the material collected consists of fractured bones which it is usually impossible to identify. The edges of the fractures are quite sharp, except where they have been gnawed by rodents before entombment. Apart from these fragments, over four

thousand determinable specimens in an admirable state of preservation were collected. This material requires no preparation, excepting to wash off the adhering clay. Few of the large bones are broken and none are crushed or distorted by pressure. The majority of the specimens collected are dissociated limb bones, jaws and teeth. Few complete skulls were found. Connected skeletons of single individuals are exceedingly rare. Associated parts of the skeletons of several squirrels and of the large bear *Arctotherium simum* were the only ones found. Remains of the latter were particularly abundant along the east wall, some of the best material occurring in loose earth at depths of from four to six feet. At this place complete limbs with all the elements in their natural position were found. The fact of the association and better state of preservation of the remains of *Arctotherium* suggested to Mr. Furlong that these animals lived in some part of the existing cave, or possibly in some gallery which has been destroyed by subsequent erosion. If these animals really lived in the cave, many of the angular fragments of bone already referred to may be the relics of bears' feasts. Associated with the bones are shells of a land mollusc referable to the genus *Epiphragmophora*, and of a fresh-water form allied to *Margaritana falcata* living in the McCloud River.

Traces of man's existence have been diligently sought, and a number of polished and pointed bones have been found which might serve as rude implements. So much depends on the determination of these as artifacts that it is deemed best to reserve judgment and await fuller exploration.

The following is a provisional list of species identified. Professor Merriam and the writer are much indebted to Dr. C. Hart Merriam for valuable assistance in determining the rodents and carnivores:

Arctotherium simum Cope.
Ursus sp. nov. Merriam, J. C.
Felis sp. nov. Merriam, J. C.
Felis near *hippolestes* Merriam, C. H.
Lynx fasciatus Rafinesque.
Lynx fasciatus subsp. nov. (?).
Urocyon townsendi Merriam, C. H.
Vulpes cascadensis Merriam, C. H.
Lupus sp. nov. Merriam, J. C.
Taxidea (?) sp. nov. Merriam, J. C.
Bassariscus raptor Baird.
Mephitis occidentalis Baird.
Spilogale sp. nov. Merriam, J. C.
Putorius arizonensis Mearns.
Sciurus hudsonicus albolimbatus Allen.
Spermophilus douglasi Richardson.
Lepus californicus Gray.
Lepus sp. nov.
Lepus klamathensis Merriam, C. H.
Lepus near *audoboni* Baird.
Teonoma sp. nov.
Neotoma fuscipes Baird.
Arvicola sp.
Thomomys sp. nov.
Thomomys near *leucodon* Merriam, C. H.
Aplodontia either a new species or a new subspecies of *A. major*.
Scalops cf. *townsendi* Bachman.
Odocoileus columbianus Richardson.
Odocoileus sp.
Camelops (?) sp.
Megaloynx sp.
Mastodon americanus Kerr.
Elephas primigenius Blumb.
Tapirus sp.
Equus occidentalis Leidy.

In addition to the species listed, there are a large number of birds which have not yet been studied, a snake, a tortoise, a bat and one or more fishes.

Associated with species characterizing open country, the list shows a considerable proportion of mountain and forest types. Seventeen of the thirty-five species and subspecies listed are extinct. So far as known there is no difference between the species from the various strata, although the remains of *Arctotherium* are perhaps more numerous in the deeper layers. No Pliocene forms have been found, although such may occur at deeper levels in the unexplored portions of the cave.

The accumulation of the portion of the cave deposit which has been studied took place during middle or later Quaternary time. Nevertheless, the cave fauna indicates that great changes in the topography of the region have taken place. The present mountainous character of the country, and especially the

ruggedness of the limestone belt in which the cave lies, are entirely out of harmony with the existence of mastodons, elephants and tapirs. Stream-worn pebbles occur in the cañon of the McCloud, at Baird, as high as 750 feet above the river. The deposit in the cave dates from a time when the river flowed at a higher elevation than it does now, but not at the 750-foot point, otherwise the cave would have been flooded, and of this there is no evidence. At this time the cave was, in part at least, an open fissure receiving material washed in during the wet season.

There are three well-defined terraces in the cañon of the McCloud. The lowest of these is about 25 feet above the mean low-water level of the river. A second terrace occurs about 30 feet higher. The best-developed terrace is about 75 feet above the stream. The cave deposit was probably formed before these terraces were cut, since a comparatively short time has been required for the river to cut down to its present level from the level of the upper terrace. This terrace is rock cut with a thin veneer of gravel on its surface. When the river flowed at the level of this terrace, it is not believed that the region was topographically adapted to the existence of tapirs and the large proboscideans, except perhaps along the stream.

A full report embodying the results of further work on the cave and descriptions of new species will appear later, in the Publications of the University of California.

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CURRENT NOTES ON METEOROLOGY.

HELM CLOUD IN THE BLUE RIDGE OF NORTH CAROLINA.

When wind is forced to cross a mountain ridge, standing waves may be produced in the air currents to leeward of the ridge. If the involuntary ascent of the air is sufficient to bring about condensation, clouds are formed in the ascending portion of these waves. The best known of these clouds is that called the *Helm Bar,* which is frequently observed when a damp easterly wind blows over the Cross Fell range, in northwestern England. Attentive observation in mountainous districts ought to bring record of the occurrence of many such clouds in different parts of the world. W. M. Davis (*Bull. Geogr. Soc. Phila.,* III., No. 5, 1903) calls attention to a similar cloud which he observed during a recent field trip to the Blue Ridge in North Carolina. On a morning with a clearing northwest wind, while standing on Mt. Mitchell, he noted that a rolling helm cloud was formed above the Blue Ridge escarpment. The cloud held its place, continually forming and dissolving, for more than an hour, while many detached fragments of the cloud floated away and disappeared during this time. This is the first mention of the occurrence of helm clouds in this section.

METEOROLOGICAL PHENOMENA OF VOLCANIC ERUPTIONS.

An ascent during an eruption of the volcano Puracé, near the city of Popayan, the capital of the Department of Cauca, in the Republic of Colombia, is described by R. B. White in the *Scottish Geographical Magazine* for February. The eruption occurred in October, 1869, and Mr. White was requested by the natives to ascend the mountain during the eruption, in order that he might report to them regarding the danger that threatened the neighborhood. A number of interesting phenomena were noted, one of which was the sudden tremendous flood which came down the river Cauca, produced by the almost instantaneous melting of 'at least 8,000,000 cubic feet of snow that lay on the mountain.' The column of steam reached a height of three miles, having the appearance of immense cumulus clouds, and spreading out at the top like the crown of a great tree. (Similar mushroom-shaped clouds were noted, and photographed, during the Mont Pelée eruptions of last summer). During the night frequent torrents of mud and rocks rushed down the mountain sides. These, Mr. White believes, came from the melting of the heavy snow which had resulted from the condensation of the great volumes of vapor thrown up from the crater. This snow melted rapidly on the

heated cone, and the water rushed down hill, gathering loose earth and rocks as it went.

JAMES GLAISHER.

JAMES GLAISHER, who died on February 7, last, although he contributed in many ways to the advancement of meteorology, will always be remembered chiefly for his famous balloon ascent on September 5, 1862, with Coxwell, when these two intrepid aeronauts reached a height of about 37,000 feet above sea level, and established a record for high ascents. With the recent rapid development of balloon meteorology, attention has naturally very frequently been directed to this famous balloon voyage, and Glaisher's account of it, published in his 'Travels in the Air,' has doubtless been more generally read within a few years than it was when the book first appeared. Glaisher made many scientific balloon ascents during the early '60's, the results of which were communicated to the British Association, and for more than fifty years he contributed reports on the meteorology of England to the periodical returns of the Registrar-General of Births, Deaths and Marriages for England and Wales. He also published some hygrometrical and temperature tables; a report on the meteorology of India, and another on the meteorology of Palestine, and was one of the founders of the Royal Meteorological Society.

ATLAS OF THE ATLANTIC OCEAN.

THERE has recently been published a second edition of the valuable 'Atlas of the Atlantic Ocean,' issued by the Deutsche Seewarte in Hamburg. This atlas, with the accompanying 'Segelhandbuch,' embodies the latest and most complete information concerning the meteorology of this ocean. Atlases and sailing directions have also been published for the Indian and Pacific Oceans. Of the charts in these atlases perhaps the most striking are those showing the generalized winds. These charts bring out, in the most emphatic manner, the great wind and calm belts of the doldrums, trades, horse latitudes and prevailing westerlies. It is a pity that no enlargements of these admirable charts of winds are available for school use.

NOTES.

IT is very significant of the advance that has been made within a few years in balloon and kite meteorology, that the results of the meteorological observations made in the free air during ascents from the Prussian aeronautical observatory have, since last November, been published daily in three Berlin newspapers.

R. DEC. WARD.

GEOGRAPHY IN THE UNIVERSITY OF CHICAGO.

THE University of Chicago has established a department of geography, and Professor Rollin D. Salisbury, of the department of geology, has been placed at its head. The arrangement between the departments of geology and geography is such that Professor Salisbury retains his connection with the former, as heretofore, at the same time that he assumes the headship of the latter. The close connection of the two departments appears from the fact that Professor Salisbury will also act as head of the department of geology when Professor Chamberlain is not in residence, and Professor Chamberlin will act as head of the department of geography in Professor Salisbury's absence.

The department of geology has heretofore offered courses, both elementary and advanced, in physical geography, and elementary courses in meteorology. Other courses of a geographic character have been offered by other departments, notably geographic botany by the department of botany, zoogeography by the department of zoology, and commercial geography by the department of political economy. These courses will continue to be given, as heretofore, by these several departments, except that meteorology will be under the auspices of the new department. The new department will not duplicate the geographic courses already given, but will, at the outset, provide courses which supplement those already established. The immediate aim of the new department will be to occupy the ground intermediate between geology and

climatology on the one hand, and history, sociology, political economy and biology on the other. The courses offered at the outset will be those for which, within his field, there is greatest demand.

John Paul Goode, Ph.D., in charge of the work of geography in the Wharton School in the University of Pennsylvania, has accepted an assistant professorship in the department of geography, and will begin his work the second term of the summer quarter (July 27, 1903). No other appointment will be made this year. During his first year, Dr. Goode will be in residence during the second term of the summer quarter, and during the autumn and spring quarters. The courses which he will give during the first year will include courses on the economic geography of (1) North America, (2) Europe and (3) tropical countries. The central theme of these courses will be the influence of the physiography, the climate and the natural resources of these lands on their settlement, development and present commercial and industrial status. Research courses will also be offered for advanced students.

The geographic work of the university during the coming year will include the following courses, in addition to those given in the department of geography:

I. In the *Department of Geology*—(1) An elementary course in physiography, each quarter; (2) A local field and laboratory course, first term, summer quarter; (3) two field courses in geology and geography about Devil's Lake and the Dells of the Wisconsin, in Wisconsin, one month each, commencing June 18 and July 27, respectively; (4) a course in advanced physiography, autumn quarter; (5) a field course (for advanced students) in the Wasatch Mountains of Utah and vicinity.

Other courses which, while primarily geological, are fundamental to the proper conception of the evolution of the present geography of the continents, will also be given in this department.

II. In the *Department of Zoology*—Courses in zoogeography, summer and spring quarters.

III. In the *Department of Botany*—(1) An elementary course in plant geography (time not announced); (2) an elementary course in ecology, summer and spring quarters; (3) elementary and advanced courses in field botany, summer and spring quarters; (4) advanced courses in geographic botany, winter quarter; and (5) a course in physiographic ecology, summer and spring quarters.

IV. In the *Department of Political Economy*—Courses in commercial geography, summer, autumn and winter quarters.

V. In the *Departments of History and Sociology*. Certain courses in these departments have a distinctly geographic bearing.

School of Education.—In addition to the foregoing, courses in geography will be given by Miss Baber in the School of Education (the normal department of the university). These courses are planned primarily with reference to the needs of teachers in the grades. Miss Baber will also conduct a field course of one month's duration during the second term of the summer quarter, beginning July 27.

A BIOLOGICAL STATION AT BERMUDA.

Harvard University and New York University unite with the Bermuda Natural History Society in inviting botanists and zoologists to spend six weeks in the temporary biological station provided for the present season at Bermuda.

By special arrangements with the Quebec S. S. Co. and the Hotel Frascati it has been possible to make the total expense, including transportation from New York and return, and board and lodging for six weeks at Bermuda, one hundred dollars.

The Bermuda Natural History Society has expressed its intention to do everything in its power to make the summer's work as profitable and pleasurable as possible, and to this end has undertaken to provide, among other things, the necessary facilities for collecting, namely, a steam launch, thirty to forty feet long with crew; a sail boat with fish-well and crew; three rowing boats, and a carriage with two horses capable of carrying ten or twelve persons. The laboratory will be equipped with all necessary reagents and utensils except microscopes and dissecting instruments, which should be brought by each investigator.

There are two possible dates of sailing from New York; June 20 and July 4. The laboratory will be opened for those who sail on June 20 and will remain open eight weeks, thus providing for those who can not sail until July 4.

The well-known richness of the sub-tropical fauna and flora, the healthfulness and equable temperature of the islands, and the ease with which they may be reached combine to make the Bermudas a most attractive field for biological research.

Venerable George Tucker, archdeacon, president, Bermuda Natural History Society.

Hon. W. Maxwell Green, Consul U. S. A., vice-president, Bermuda Natural History Society.

F. Goodwin Gosling, honorary secretary, Bermuda Natural History Society.

E. L. Mark, director Zoological Laboratory, Harvard University.

C. L. Bristol, professor of biology, New York University.

Circulars and detailed information will be supplied on application either to Professor C. L. Bristol, University Heights, New York City, or to Professor E. L. Mark, 109 Irving St., Cambridge, Mass.

PROGRESS TOWARD AN INTERNATIONAL COMMISSION OF ARCHEOLOGY AND ETHNOLOGY.

DURING the Second International Conference held in Mexico in the winter of 1901–1902, a proposal that the creation of an International Archeologic Commission be recommended to the participating countries received much attention; and on January 29, 1902, a formal recommendation to that effect was adopted. It is printed *in extenso,* in Spanish, English and French, on pages 141–147, in the report of 'Recomendaciones, Resoluciones, Convenciones y Tratados,' published officially soon after the adjournment of the conference.

Action was taken on the recommendation within a few months by the Republic of Mexico, President Diaz appointing Señor Don Alfredo Chavero (a distinguished archeologist, soon afterwards made director of the Museo Nacional) to inquire into the feasibility of establishing such a commission, and to confer with representatives of other countries. Dr. Chavero visited the United States in the autumn of 1902, and conferred with the diplomatic representatives of the various American countries in Washington, as well as with the archeologists and ethnologists in attendance at the International Congress of Americanists held in New York in October. On returning to Mexico he reported progress, pursuant to which President Diaz delegated His Excellency, Señor Don Manuel de Aspiroz, the Ambassador from Mexico to the United States, as a representative of the commission empowered to treat with similar delegates from other countries.

The recommendation of the International Conference came to the notice of several scientific societies in this country; and on July 1, 1902, the American Association for the Advancement of Science and the American Anthropological Association adopted resolutions approving the contemplated action.

In November, 1902, the Secretary of State designated Dr. W J McGee, ethnologist in charge, Bureau of American Ethnology, as a representative on the part of the United States to confer with similar representatives on the part of other countries in arranging for the organization of the commission; being in the City of Mexico soon afterwards, he conferred with President Diaz, Dr. Chavero and others, and after his return continued the conferences with the Mexican Ambassador as well as with Honorable W. W. Rockhill, director of the Bureau of American Republics. In these conferences a plan for the organization of the commission was framed.

On April 15, 1903, a meeting of representatives of several American countries, convoked by the Secretary of State at the instance of the Ambassador for Mexico, was held in the State Department. The draft of plan for organization of the commission was submitted by His Excellency, Señor de Aspiroz, and some of its features were explained by Dr. McGee. After full discussion the plan was approved without dissenting voice; the representatives of four countries signified the intention of adopting it on behalf of their governments, while other ministers explained the necessity of withholding final action pending instructions from their respective governments, and it was

unanimously voted to recommend the adoption of the plan and the making of a moderate appropriation for carrying out its purposes to the several American countries. It was also decided by a unanimous vote to assemble in session for final organization on the third Monday in December, 1903, and meantime to invite the several American governments to designate commissioners to attend this session and participate in the organization.

Under the plan adopted the commission is designed to form an administrative corps and include a scientific corps, the former to be made up of commissioners officially designated by the participating governments, to a number not exceeding three from each, and to have a president, two vice-presidents, and a secretary, to be elected for terms of four years; the commissionerships and these administrative offices to be honorary. The scientific corps is designed to include trained scientists and scientific attachés, to be chosen by the commission, with a director-general and a secretary, and a director for each participating country; these positions to be either honorary or salaried, and commissioners being eligible. The specified objects of the commission are (1) to promote the unification of laws relating to antiquities in the Western Hemisphere; (2) to increase and diffuse knowledge concerning these antiquities and the aboriginal peoples by whom they were produced; (3) to awaken interest in the vestiges of a vanishing race; (4) to unify museum methods throughout the American countries; and (5) to work for the establishment of one or more archeologic and ethnologic museums of international character. Provision is made for the acquisition, preservation and transfer of museum and office property, for the exchange of collections and scientific workers among the several countries, for annual and special sessions of the commission and the scientific corps, and for the preparation and publication of reports. The recommendations of the International Conference extended to the custody and preservation of aboriginal structures, and it is planned to take up this duty as the work of the commission proceeds.

SCIENTIFIC NOTES AND NEWS.

At the stated session of the National Academy of Sciences on April 21, 22 and 23, new members were elected as follows: T. C. Chamberlin, professor of geology, University of Chicago; William James, professor of philosophy, Harvard University; E. L. Mark, professor of anatomy, Harvard University; Arthur G. Webster, professor of physics, Clark University; Horace L. Wells, professor of analytical chemistry and metallurgy, Yale University. President Ira Remsen, of the Johns Hopkins University, was elected vice-president, and Professor Simon Newcomb, foreign secretary. Professor George E. Hale, director of the Yerkes Observatory, was awarded the Draper medal and made a member of the council. Foreign associates were elected as follows: W. C. Brogger, professor of mineralogy and geology, University of Christiana; Robert Koch, professor of hygiene, University of Berlin; E. Ray Lankester, director of the British Museum of Natural History; D. J. Mendeleef, professor of chemistry, St. Petersburg; Wilhelm Pfeffer, professor of botany, University of Leipzig; M. Picard, professor of mathematics, University of Paris; J. J. Thomson, Cavendish professor of physics, Cambridge University; H. K. Vogel, director of the astrophysical observatory near Potsdam; and Ferdinand Zirkel, professor of mineralogy, University of Leipzig.

Professor Simon Newcomb, of Washington, has been appointed a delegate from the National Academy of Sciences to the International Association of Academies, which meets in London this coming June. Mr. S. F. Emmons and Mr. Geo. F. Becker, of Washington, and Professor C. R. Van Hise, of Madison, Wis., have been appointed delegates to the International Geological Congress, which meets in Vienna in August of this year.

At the request of the Secretary of State, the president of the National Academy of Sciences has appointed a committee to consider what means, if any, should be taken to preserve the original copy of the Declaration of Independence. The signatures of the signers

are now nearly obliterated, and the parchment shows evidence of decay. The committee appointed consists of Dr. Chandler, of Columbia University; President Remsen, of Johns Hopkins University, and Dr. Billings, Librarian of the New York Public Library.

AT the meeting of the American Academy of Arts and Sciences held April 8, 1903, in the Harvard University Museum, the Rumford premium, consisting of a gold and a silver medal, was presented to Professor George E. Hale, director of Yerkes Observatory, in recognition of his researches in solar and stellar physics and in particular for the invention and perfection of the spectro-heliograph. The grounds of the award of the premium were explained to the academy by the chairman of the Rumford committee, Professor Charles R. Cross; the medals were presented by the president of the academy, Dr. Alexander Agassiz, and Professor Hale in connection with his acknowledgment of the honor conferred upon him described his work and exhibited a number of lantern slides in illustration.

THE University of Edinburgh has conferred the degree of LL.D. on Dr. Arthur Gamgee, F.R.S., emeritus professor of physiology at Owens College, Manchester, and on B. N. Peach, F.R.S., of the Geological Survey Office, Edinburgh.

DR. A. HRDLICKA has been appointed assistant curator of the Division of Physical Anthropology at the U. S. National Museum.

MR. HENRY E. WILLIAMS has been appointed assistant chief of the U. S. Weather Bureau. This position was created by the last agricultural appropriation act.

SIR ARCHIBALD GEIKIE, F.R.S., has been elected an honorary member of the British Institution of Civil Engineers.

DR. SIMON FLEXNER, professor of pathology at the University of Pennsylvania, director-elect of the Rockefeller Institute for Medical Research, was given a dinner at the University Club, Philadelphia, on April 16, Dr. S. Weir Mitchell presiding.

THE Association for maintaining the American Woman's Table at the Zoological Station at Naples and for promoting Scientific Research by Women has awarded its prize of $1,000, offered two years ago, for the best scientific research done by a woman, to Dr. Florence R. Sabin, assistant in anatomy at the Johns Hopkins University Medical School. She presented a research on the 'Origin of the Lymphatic System.' Honorable mention was given to a paper entitled 'Contributions to the Life History of Pinus,' by Miss Margaret Clay Ferguson, instructor in botany at Wellesley College. The prize will again be awarded in 1905. Miss Grace E. Cooley, associate professor of botany at Wellesley College, has been awarded the table at the Naples Station.

The British Medical Journal states that the executive committee of the Carnegie Institution, Washington, has made a grant of $5,000 and traveling expenses to Professor Arthur Gamgee, emeritus professor of physiology, Owens College, Manchester, to enable him to prepare a report on the physiology of nutrition. The object in view is to secure information which may lead to the organization in the laboratories of various countries of cooperative research in the problems of human nutrition.

DR. ALBERT P. MATTHEWS, assistant professor of physiological chemistry at the University of Chicago, lectured before the Yale Alumni Association on April 22, his subject being 'The Action of Inorganic Salts on Protoplasmic Activities.'

DR. DUNCAN S. JOHNSON and Mr. Forrest Shreve, of Johns Hopkins University, have gone to Jamaica for special work in botany. They will join Professor L. M. Underwood, of Columbia University.

THE party from the Lick Observatory of the University of California, which is to establish a temporary observatory in Chili, has arrived at Santiago.

MR. THOMAS H. MEANS, of the Bureau of Soils, Department of Agriculture, has returned from an investigation on the methods of reclaiming alkali lands in Egypt, the re-

sults of which will be shortly published in a bulletin.

Dr. Jean Charcot, of Paris, has decided to go to the Antarctic instead of the Arctic regions. He will go first to Terra del Fuego and thence to Alexander Island, whence he will endeavor to penetrate as far as possible into the South Polar continent.

Articles of incorporation of the John Fritz Metal Fund Corporation have been filed at Albany. It will be remembered that the medal is to be conferred under the auspices of our four great engineering societies. The directors of the corporation are J. J. R. Croes, Alfred Noble, C. W. Hunt, E. E. Olcott, E. G. Spilsbury, James Douglass, C. Kirchoff, New York City; Robert Moore, of St. Louis; Gaetano Lanza, of Boston; John E. Sweet, of Syracuse; Robert W. Hunt, of Chicago; S. T. Wellman, of Cleveland; Arthur E. Kennelly, of Cambridge, Mass.; Carl Hering, of Philadelphia; Charles P. Steinmetz, of Schenectady, and Charles F. Scott, of Pittsburgh.

Dr. Josiah Willard Gibbs, since 1871 professor of mathematical physics at Yale University, died on April 28.

Dr. Moritz Lazarus, honorary professor of psychology at the University of Berlin, died on April 13, at the age of seventy-nine years.

Mr. Andrew Carnegie, before leaving for Scotland on April 24, offered to give $1,500,000 for the erection of a court house and library for the permanent court of arbitration established at The Hague by the treaty of July 29, 1899. Mr. Carnegie also gave last week five per cent. U. S. Steel Company first mortgage bonds, the par value of which is $600,000 and the market value about $500,000, to the endowment fund of the Tuskegee Normal and Industrial Institute.

A Reuter telegram from Wiesbaden reports that the International Conference on Deep-sea Investigation was opened there on April 17, under the presidency of the Prince of Monaco, those present including professors of geography and other geographical experts from England, Germany, France, Norway and Sweden. The committee appointed by the Geographical Congress which met in 1899 presented a report on questions connected with oceanic research at great depths. The conference was engaged in the preparation of charts of the ocean beds to be sent to the next International Geographical Congress, which is to meet at Washington in 1904.

Nature states that the biennial Hunterian Oration was delivered on the afternoon of February 14, by Sir Henry Howse, president of the Royal College of Science, in the theater of the college. He devoted the greater part of his oration to interesting biographical incidents concerning John Hunter, who was elected a fellow of the Royal Society in 1767, and appointed surgeon-extraordinary to the King in 1776. The collection of the objects in his museum was Hunter's chief interest through many years of his life, and at his death there were 14,000 specimens in the museum, on which Hunter spent 70,000*l*. A banquet took place in the evening in the library of the college, at which the honorary fellowship of the college was conferred on Lord Roberts, who, in his reply, referred to the outbreaks of enteric fever at Bloemfontein and Kroonstad during the late war, and expressed his admiration for the way in which the medical officers managed to meet all emergencies with a minimum of appliances.

It is announced from Washington that Secretary Hitchcock, of the Interior Department, has granted authority for the acquisition of necessary property, rights of way, etc., prior to the construction of irrigation works in five localities. These projects are: Wyoming, Sweetwater dam; Montana, Milk River; Colorado, Gunnison tunnel; Nevada, Truckee; Arizona, Salt River reservoir. These projects are estimated to cost $7,000,000, and will provide for the irrigation of about 600,000 acres of arid land. In addition thereto the Gray Bull reservoir project is to be taken up immediately. The construction remains subject to the feasibility of obtaining the necessary rights and the adjustment of private claims. The authority granted relates to the projects upon which the examinations have been made in sufficient detail to justify estimates of cost

and results. Several others, in other states, are well advanced as regards investigation, and it is expected that further recommendations can be made after the close of the coming field season. The secretary also has authorized the expenditure, during the present calendar year, of $450,000 on surveys, borings for foundations, and other examinations, which will be carried on in all the states and territories included within the provisions of the law.

ACCORDING to a Reuter message from Vienna, Professor Behring, the discoverer of the diphtheria serum, lectured before the Vienna Medical Society upon the results of his experiments with tuberculosis serum, which have so far been confined to animals and have proved entirely successful. The professor at present, however, considers it inadvisable to experiment on human beings. His serum is produced by cultivation of the bacillus of human tuberculosis, which is dried in a vacuum in order to prevent loss of virulence. An ordinary dose consists of four centigrams of bacilli mixed with water. It is injected subcutaneously into the veins. In very few cases, said the lecturer, did the experiments prove unsatisfactory on account of fever, difficulty in breathing, and accelerated pulse, but even in these cases the animals proved immune against animal tuberculosis. Professor Behring found that with younger animals the reaction was less than in the case of older animals, which suffered from severe reaction, besides losing their immunity more quickly. He thought, therefore, that in the event of the serum's proving a success persons should be inoculated in their earliest childhood. Professor Behring admitted that he was unable to tell how soon people might expect to be able to protect themselves against tuberculosis by the injection of serum. Incidentally the lecturer declared that the question of heredity was far less important than many people believed. He attached greater importance to contagion.

THE London *Times* reports that M. Moissan communicated to the French Academy of Sciences at its meeting on March 16 a paper giving the results of an inquiry conducted by himself in collaboration with Professor Dewar into the solidification of fluorine, and its behavior in contact with liquid hydrogen at the temperature of 20 degrees absolute or, say, *minus* 252 degrees centigrade. While one of the collaborators has produced liquid hydrogen in large quantities, the other has isolated fluorine gas in a state of absolute purity, and has demonstrated that this most active of known elements does not attack glass when perfectly free from moisture. Thus it has become possible by sealing pure fluorine in a glass tube and immersing it in liquid hydrogen to show its liquefaction and solidification, and to prove that its point of fusion is at —233 degrees centigrade. It remained only to bring the two elements together at that temperature in order to discover whether chemical activity is entirely suspended as in the case of nearly all other substances. The dangerous experiment was made by breaking the fluorine tube in 100 c.c. of liquid hydrogen, and the result was a violent explosion, accompanied by a volume of flame and the shattering of the apparatus employed. It is thus demonstrated that, whatever may be the case at the absolute zero, certain reactions continue to occur at a temperature only 20 degrees above it when an element so energetic as fluorine is in question.

A REUTER telegram from Vienna, dated March 15, says: "Professor Hans Molisch, of Prague, has reported to the Vienna Academy of Sciences the discovery of a lamp lighted by means of bacteria, which, he claims, will give a powerful light and be free from danger, thus being valuable for work in mines and powder magazines. The lamp consists of a glass jar, in which a lining of saltpetre and gelatine inoculated with bacteria is placed. Two days after inoculation the jar becomes illuminated with a wonderful bluish green light, caused by the innumerable bacteria which have developed in the time. The light will burn brilliantly for from two to three weeks afterwards, diminishing in brightness. It renders faces recognizable at a distance of two yards, and large type is easily legible by it. Professor Molisch asserts that the lamp yields a cold light which is entirely safe."

UNIVERSITY AND EDUCATIONAL NEWS.

The board of regents of the University of Wisconsin on April 21 elected Dr. Charles R. Van Hise, professor of geology, to the presidency of that institution, the term of service to begin with the next academic year, or so soon thereafter as Dr. Van Hise can be freed from existing engagements.

Dr. John H. Finley, professor of politics at Princeton University, has been elected president of the College of the City of New York. Three professors of the college, Robert A. Doremus, chemistry; Solomon W. Wolf, descriptive drawing, and James W. Mason, mathematics, retired with pensions on reaching the age limit.

The building on the campus of Rutgers College, occupied by the New Jersey State Experiment Station and Agricultural College, was almost completely destroyed by fire on April 23. The loss is estimated at $40,000, which is nearly covered by insurance. Most of the collections were saved, but damage was done to those of the botanical and biological departments.

President D. S. Jordan, of Stanford University; President Wheeler, of the University of California, and Dean Norton, of Pomona College, constituting a committee on the award of the Rhodes scholarships from the state of California, have decided that the first scholarship shall be granted to the University of California. The award will be made next winter, and the following year a scholarship will be given a Stanford graduate.

The University of Chicago has established the degree of Bachelor of Education for two years' professional work in the School of Education. Students are to be admitted to the school from the junior colleges of the university and from certain approved high schools.

The Summer School in Mining of McGill University will be held this year in the iron and copper districts of Michigan. The work of the school will be carried out chiefly in the Marquette range, with Ishpeming as headquarters, and in the district about Houghton. In the latter locality the instruction will be given chiefly in the workings and mills of the Atlantic and Baltic mines. On the way west the party will stop at Sudbury and at Sault Ste. Marie to examine the metallurgical plants at these places. The geological work in connection with the school will be done in the Marquette district. The party leaves Montreal in a special car on April 27 and will return about the middle of June. The school will be in charge of Dr. J. B. Porter, professor of mining in McGill University, and the instruction in geological field work will be given by Dr. Frank D. Adams.

About one hundred cases of typhoid fever have occurred at Palo Alto, largely among the students of Stanford University. The disease is, however, of a mild type, only one death having occurred. It was caused by contaminated milk.

Dr. L. A. Bauer, as lecturer in terrestrial magnetism, will give his annual course of instruction in magnetic work at the Johns Hopkins University during the week April 27 to May 2.

John L. Sheldon, of the botanical department of the University of Nebraska, has accepted the position of professor of bacteriology in the West Virginia University, and bacteriologist to the agricultural station. He will assume his new position September 1, and will spend this summer as instructor in botany in the Colorado Springs Summer School. Mr. Sheldon comes up before the faculty of the University of Nebraska in June for the degree of Doctor of Philosophy (in botany).

Mr. Frank L. Hann, who has been assistant in chemistry at Cornell College, Iowa, has been chosen an instructor in the chemical department of Morningside College, at Sioux City.

Dr. Arnold Emch, heretofore assistant professor of pure and applied mathematics in the University of Colorado, has been promoted to a full professorship of graphics and mathematics.